

# Statistical Measurement and Analysis for Quality Improvement

## W'07 Syllabus - ECS 126

### Instructors:

Mark E. Splaine, MD, MS  
Health Care Improvement, Leadership  
Development  
308 Strassenburg Hall  
Hanover, NH 03755  
Telephone: (603) 650-6515  
E-mail: [mark.splaine@hitchcock.org](mailto:mark.splaine@hitchcock.org)

Stephen K. Plume, MD  
Health Care Improvement, Leadership  
Development  
305 Strassenburg Hall  
Hanover, NH 03755  
Telephone: (603) 650-6520  
E-mail: [stephen.plume@hitchcock.org](mailto:stephen.plume@hitchcock.org)

Greg Ogrinc, MD, MS  
VA Medical Center  
White River Junction, VT 05001  
Telephone: (802) 291-6285  
E-mail: [greg.ogrinc@med.va.gov](mailto:greg.ogrinc@med.va.gov)

Karen Homa, PhD  
Leadership Preventive Medicine Residency  
122 Strassenburg Hall  
Hanover, NH 03755  
E-mail: [karen.homa@hitchcock.org](mailto:karen.homa@hitchcock.org)

### Teaching Assistants:

Susan E. Mooney, MD  
[Susan.E.Mooney@hitchcock.org](mailto:Susan.E.Mooney@hitchcock.org)

Jason Aaron, MD  
[Jason.Aaron@hitchcock.org](mailto:Jason.Aaron@hitchcock.org)

### Contacts and Assistance:

Liz Koelsch  
Telephone: (603) 650-1753  
E-mail: [liz.koelsch@dartmouth.edu](mailto:liz.koelsch@dartmouth.edu)

Joy McAvoy  
Telephone: (603) 650-6512  
E-mail: [joy.mcavoy@dartmouth.edu](mailto:joy.mcavoy@dartmouth.edu)

## **Overview**

### 1) Class:

Will meet on Tuesdays from 1 p.m. to 5 p.m. in the CECS Education Program main classroom. There will be one exception to this time:

- On 1/17, there will be an optional lab session to gain basic skills in the use of Excel from 4:00 p.m. to 6:00 p.m. (Pizza will be served.)

### 2) Required Text:

Carey RG. Improving Healthcare with Control Charts: Basic and Advanced SPC Methods and Case Studies. Milwaukee, WI: ASQ Quality Press, 2003.

### 3) Optional Supplemental Texts:

Wheeler DJ. Making Sense of Data. Knoxville, TN: SPC Press, Inc., 2003.

- Copies will be on reserve at Dana Library and available for purchase.

### 4) Articles:

A coursepack containing the article citations and electronic references for each session will be available prior to the first class.

### 5) Software: We will use the following programs in our lab sessions to analyze data:

Microsoft Excel (this will include templates for creating control chart that will be given to you)  
SPC XL add-on software for Microsoft Excel for those who use PC computers  
SPC for Excel add-on software for Microsoft Excel for those who use Mac computers

## **Class Pre-Work (ideally completed before the first class session)**

### 1) Self-Evaluation:

- Complete this form e-mailed to each student separately.

### 2) Goals for the course:

- Please write down your goals for what you hope to accomplish by taking this course.

## **General Course Learning Objectives:**

- Gain a deep understanding for the development of the science of studying and measuring variation in daily work and the application of that work to the improvement of patient care. This understanding will include:
  - Initial work done outside of health care;
  - Current efforts in health care;
  - Future needs to further develop this field in health care.

## **Specific Course Learning Objectives:**

- Demonstrate the ability to construct measures of quality, or to improve them.
- Understand the underlying concepts of the temporal display and analysis of data, specifically including run charts and control charts and be able to use them with different types of data.
- Develop skills in analyzing datasets and presenting data for improvement work.
- Demonstrate an ability to critically appraise literature that incorporates measurement of variation.

## **Course Expectations:**

- 1) Complete pre-readings and prepare for class.
- 2) Actively participate in class discussions.
- 3) Hand in all laboratory assignments.
- 4) Complete the final exam.
- 5) Design and complete a group measurement project using real data (contribution expected from all group members).
- 6) A presentation will be presented by each project group at the end of the course.
- 7) Self and group evaluations will be completed and make up a portion of each student's final grade

## **Lab Expectations:**

There are 3 learning objectives that occur during the process of completing a lab assignment.

- 1) To learn how to go from an observation or question about a concrete experience in health care to addressing this concern through data analysis and creating data displays, which then helps guide thinking, interpretation, and/or reflection about improvement opportunities in a health care process.
- 2) To learn how to use Excel, such as to convert the data into a form to place into a statistical process control chart and to format your chart as desired.
- 3) To write a concise and thoughtful lab report (in essence an engaging report for a time-limited health care supervisor/leader/manager).

There are several assignments that are due over the 10-week term. The lab process is as follows:

- 1) Generally, the last hour of class will be dedicated to stepping through the initial stages of the lab assignment, such as how to convert the data to a form to place it into a statistical process control chart. The majority of the Excel skills needed to create charts and format them will be learnt during this time. Mark Splaine leads the lab.
- 2) Lab assignment also requires answering all the questions and summarizing your thoughts and interpretations relative to improving health care.
- 3) Your final lab write-up is expected to be a concise well-organized lab with connections to improvement opportunities, strategies, and/or change ideas to move

- the concern to the next step in health care improvement. Please consider this as practice or a rehearsal for writing a report for (or having a conversation with) a time challenged future health care boss.
- a. Please use 12 point Times font, 1.50 line spacing and 1.25 inch margins.
  - b. Label your charts, such as Figure 1 and refer to the chart in your text by that label.
  - c. Include your mailbox number (top section of the first page).
- 4) Labs are due at the beginning of the following class since TAs review the lab assignment during the first hour of class. A few students have found it helpful in their learning experience to hold onto their labs during this time to write notes on them. If you find this helpful then please do so. Labs will be picked up at the first break and any labs after that are considered late.
  - 5) TAs will review your labs, provide grades and give feedback comments. The grading is the following:  
0 = no lab is turned in, or lab turned in but did not meet basic expectations.  
1 = lab turned in and basic expectations met for the assignment.  
2 = grade for those who go beyond the basic expectations for the assignment.
  - 6) Late labs are accepted since it's crucial to practice making the charts and writing the interpretation. These labs are very similar to the questions on the final exam; therefore any practice you get is worth the time. Late labs are graded at 1 as long as they meet expectations for the assignment.
  - 7) TAs will try to return your labs by the next day in your mailboxes.
  - 8) The best way to contact TAs outside of class time is by email.

### **Student Projects:**

The project will give students an opportunity to find data related to a topic; link the data to a clinical or administrative process; display, analyze, and interpret the data; and summarize conclusions. Students will be encouraged to use data from their own work, as this assignment will have highest utility when applied to an existing opportunity. Students will work in groups. Groups who do not have existing data will be expected to alert the instructor **during the first or second week of class**. This will enable the course instructor to assist groups in finding data to analyze and display.

**Projects will be due in class on Tuesday, February 27, 2007.** Each group will present its project to the class on March 6 or March 13, 2007.

The following summary should be used to guide the preparation of your project:

#### *Overview*

The class project offers an opportunity to translate your learning from class into an analysis and interpretation of dataset. This project models the experience you will have in applying what you learn in class to real-world situations.

#### *Description*

The project is designed for you to summarize information, discover improvement opportunities, and make suggestions on how to improve care. The project report should include an aim, a description and diagram of the process under study, a description of the data and methods of analysis, and conclusions and implications. This is not just an exercise in data analysis and display. The data is the focus, but we want you to integrate the data into the process of care and use of improvement knowledge.

You are encouraged to use data from your own work if possible. If this is not possible, we can provide data for you to use. You will work on the project during the course. To facilitate your progress, we have designed two lab sessions exclusively to work on your project. Faculty will be available during these sessions to help with any questions your group may have.

### *Group Work*

This project will be done in groups. You need to find 2 or 3 colleagues with whom to work. You must inform the faculty of your group by Week 2 of class.

### *Write-up*

The following is a suggested outline for you to follow in writing up your project. The written portion should be no more than **2250 words** in length. Graphs, tables, figures, and references can be placed after your text. Refer to each of these in the text.

There will be a few examples of projects from last year on reserve in Dana for you to examine. You may use these to guide your work.

Write-ups are due in class on Tuesday, February 27, 2007.

### *Presentation*

In the final 2 sessions of the course (March 6 and March 13, 2007), each team will present a summary of its project to the class. One-half of the teams will present on March 6th and the other half on March 13<sup>th</sup>. This presentation – with PowerPoint or overhead transparencies – will be no longer than 10 minutes. There will then be a 10-minute discussion period.

### *Suggested Format for Write-up and Presentation*

You may use these as headers in your paper, or choose other, similar headers if they are more applicable to your project. Please refer to the article by Davidoff and Batalden titled, “Toward stronger evidence on quality improvement. Draft publication guidelines: the beginning of a consensus project” for more detailed information about the structure of the paper. We recognize that you will not be able to incorporate all aspects of the guideline in this limited project, but use these guidelines as a reference.

- 1) Background/Introduction
  - Why is this important?
  - Give a brief summary of the current organizational and clinical knowledge about the problem.
  - Include a specific aim about
- 2) Methods
  - Define the population being studied and the setting
  - Define the process (a graphical representation – such as a flow diagram or a cause and effect diagram – might be very helpful)
  - Describe your data
    - Where does it come from?
    - On which measures will you focus? Why did you choose these? How are they defined?
  - Describe your analysis plan

- Why are you looking at the data this way?
  - Why did you choose these methods to display the data?
  - What specific question(s) will you answer with these data?
  - Be sure to link the data display back to the process as described in 2).
- 3) Results and interpretation
- What does the data show? How do you interpret these results?
  - How does this evaluation help you understand the process?
  - Have any of the changes in the process (intended or unintended) affected the outcome over time?
- 4) Discussion
- Provide a summary of the main findings. This is not a recapitulation of the results, but rather a summary of main points.
  - What are the limitations of the current analysis?
  - How does your data display assist in decision-making? What actions would you recommend as a result of your analysis?
  - Are there other data that would help support your decision?
  - Overall, how did the group function? What tips would you suggest to make the group operate more smoothly if you had to do the project over again?

### *References and Citations*

It is expected that each project will include appropriate references related to the background for the project. Additional references should be included at other points in the project summary if citing other work or sources. Any graphs, figures or tables used in the project summary that are not generated by the team must be cited as to the source of the information.

Please direct any questions regarding the class project to Greg Ogrinc. He can be reached through email at [greg.ogrinc@med.va.gov](mailto:greg.ogrinc@med.va.gov) or by phone at 802-291-6285.

### **Grading Policy:**

All students who attend class and meet the above expectations including submitting of assignments on time will receive a grade of “Pass.” In addition, students who demonstrate an exceptional understanding of the course materials and an ability to integrate them into their own work will receive a grade of “High Pass.” A grade of “Low Pass” is awarded to students who have completed course assignments, but the overall quality of the assignments has not met appropriate course standards. Failure to complete the course assignments will mean a grade of “No Credit.”

## Outline of Course by Week:

### Week 1 (1/9): Development of the Science of Studying Variation

#### Learning Objectives:

- Review the initial reasoning for studying variation in the workplace.
- Describe how that thinking has developed over time.
- Discuss the current and future challenges for this thinking in health care.

Readings: Carey RG. Improving Healthcare with Control Charts. pp. 1-19, 53-58.

#### Coursepack:

- Benneyan JC, Lloyd RC, Plesk PE. Statistical process control as a tool for research and healthcare improvement. *Qual Saf Health Care*. 2003;12:458-464. <http://qshc.bmj.com/cgi/reprint/12/6/458>
- Boggs PB, Hayati F, Washburne WF, Wheeler DA. Using statistical process control charts for the continual improvement of asthma care. *Joint Comm J Qual Improve*. 1999;25:163-181.  
**Not available electronically. Please see handout.**
- Davidoff F, Batalden P. Toward stronger evidence on quality improvement. Draft publication guidelines: the beginning of a consensus project. *Qual Saf Health Care*. 2005;14:319-325. <http://qshc.bmj.com/cgi/reprint/14/5/319>

Optional Reading: Wheeler DJ. Making Sense of Data. Chapters 9-11, pp. 121-172.

Laboratory: Getting Started

- *Aim:* 1) Check on software and distribution of initial dataset  
2) Review of basic control chart principles from ECS 117
- *Assignment:* Make a control chart using Excel templates

## **Week 2 (1/16): Designing and Using Measures to Understand Variation and Quality in Health Care**

### Learning Objectives:

- Develop an understanding of what is needed to create a good measure.
- Discuss how to ask good questions for developing measures.
- Practice creating some measures for health care.

Readings: Carey RG. Improving Healthcare with Control Charts. pp. 95-108 (Benchmarking included in this section will be covered in detail in Week 9).

### Coursepack:

- Batalden PB, Nelson EC, Roberts JS. Linking outcomes measurement to continual improvement: the serial "V" way of thinking about improving health care. *Joint Commission Journal on Quality Improvement*. 1994;20:167-180. **Not available electronically. Please see handout.**
- Nelson EC, Splaine MS, Batalden PB, Plume SK. Building measurement and data collection into clinical practice. *Ann Intern Med*. 1998;128:460-466. <http://www.annals.org/cgi/content/abstract/128/6/460>
- Spertus JA, Eagle KA, Krumholz HM, Mitchell KR, Normand ST, et al. American College of Cardiology and American Heart Association methodology for the selection and creation of performance measures for quantifying the quality of cardiovascular care. *Circulation*. 2005;111:1703-1712. <http://circ.ahajournals.org/cgi/content/full/111/13/1703>
- Gaynes RP, Platt R. Monitoring patient safety in health care: building the case for surrogate measures. *Joint Commission Journal on Quality and Patient Safety*. 2006;32:95-101. <http://www.ingentaconnect.com/content/jcaho/jcjq/2006/00000032/00000002/art00005>
- Curtis JR, Cook DJ, Wall RJ, Angus DC, Bion J, Kacmarek R, Kane-Gill SL, Kirchhoff KT, Levy M, Mitchell PH, Moreno R, Pronovost P, Puntillo K. Intensive care unit quality improvement: a "how-to" guide for the interdisciplinary team. *Critical Care Medicine*. 2006;34:211-218. <http://gateway.ut.ovid.com/gw1/ovidweb.cgi?QS2=434f4e1a73d37e8c85021fea6c0d7731b56b6c6e6191bc2a01a2504334a84354b11a0b0062a720c9f039b8f6360fad6ec841580524057476572914a9b8e8fa91f1541eacb8e29660bdec781058266fba03107664942197f5aa4871b32cc5336e9f00a216eb01235fdb3350531a6b32d3dd6907241441baf39e24abd201998c3dd978d7c4d6adf514cde7108b6a37645c12de9abd364e26863c8d51ff0d89a6cb923c1211c55b0db7102d14b5093d178f271969cc0bf6cedcbbec06d02368d69cc26a5d6a2bd23cdaf5a3f9bdfb29cb761ac21c9be144cc7166d19e801785aa1d6b00fd37d0e5d28>

Optional Reading: Wheeler DJ. Making Sense of Data. Chapters 1-3, pp. 1-38.

Laboratory: Administrative Data Lab

- *Aim:* Analyze a dataset of measures from the perspective of a particular clinical condition (OB and CHF care), and then from the perspective of a Quality Director.
- *Assignment:* 1) Make control charts of the measures for OB or CHF.  
2) Describe what other measures would be helpful in understanding the care for the condition you choose.  
3) Interpret the data and summarize your thoughts.

**Week 2 (1/17): (Optional Session) Using Microsoft Excel to Analyze and Display Data**

Learning Objectives:

- Develop an understanding of how to use Excel to create control charts.
- Learn about different options for displaying and printing charts in Excel.
- Practice these skills with some data.

Laboratory: Data display in Excel

- *Aim:* To practice using Excel templates for control charts and to learn different methods for displaying data.

## Week 3 (1/23): Display of Data to Maximize the Sharing of Information, Taking the Correct Action

### Learning Objectives:

- Understand what constitutes an effective measurement display.
- Demonstrate the ability to create a useful, effective display of data.

### Readings:

#### Coursepack:

- Nelson EC, Batalden PB, Plume SK, Mihevc NT, Swartz WG. Report cards or instrument panels: who needs what? *Joint Comm J Qual Improve.* 1995;21:155-166.  
**Not available electronically. Please see handout.**
- Hofer TP, Hayward RA, Greenfield S, Wagner EH, Kaplan SH, Manning WG. The unreliability of individual physician “report cards” for assessing the costs and quality of care of a chronic disease. *JAMA.* 1999;281:2098-2105.  
<http://jama.ama-assn.org/cgi/reprint/281/22/2098>
- Elting LS, Martin CG, Cantor SB, Rubenstein EB. Influence of data display formats on physician investigators’ decisions to stop clinical trials: prospective trial with repeated measures. *BMJ.* 1999;318:1527-1531.  
<http://www.bmj.com/cgi/content/full/318/7197/1527>
- Wyatt J. Same information, different decisions: format counts. *BMJ.* 1999;318:1501-1502.  
<http://www.bmj.com/cgi/content/extract/318/7197/1501>
- Goldberg H, et al. Can Evidence Change the Rate of Back Surgery? A Randomized Trial of Community-Based Education. *Effective Clinical Practice.* 2001;4:95-104.  
<http://www.acponline.org/journals/ecp/mayjun01/goldberg.htm>

Optional Reading: Wheeler DJ. Making Sense of Data. Chapters 4-5, pp. 39-80.

### Laboratory: Project Lab #1

- *Aim:* Assess your group and begin to develop a plan for your class project.
- *Assignments:*  
Group Assessment
  - 1) Review your self-assessment forms.
  - 2) What are the overall strengths of this group?
  - 3) Are there any skills not represented in the group that you may need?Project Planning
  - 1) Describe the data, including measures and data collection.
  - 2) Define the population you are studying.
  - 3) Describe the context in which the data are being gathered and the specific process you will be studying.
  - 4) Write an aim for your project.

## Week 4 (1/30): Additional Types of Control Charts, Part 1

### Learning Objectives:

- Build on existing knowledge of XmR charts
- Review the X-bar and R and X-bar and s types of control charts.
- Understand which chart should be used for which measure.
- Demonstrate understanding of when to change limits on a control chart.
- Understand how the control limits are created for each of the charts.

Readings: Carey RG. Improving Healthcare with Control Charts. pp. 19-23, 98-100.

### Coursepack:

- Amin SG. Control charts 101: a guide to health care applications. *Quality Management in Health Care*. 2001;9:1-28.  
<http://web.ebscohost.com/ehost/pdf?vid=4&hid=120&sid=9bffe1d9-4bca-4875-852c-14c1c31f1f6d%40sessionmgr9>
- Lee K. McGreevey C. Using control charts to assess performance measurement. *Joint Commission Journal on Quality Improvement*. 2002;28:90-101.  
<http://docserver.ingentaconnect.com/deliver/connect/jcaho/15537250/v28n2/s4.pdf?expires=1164923446&id=33752194&titleid=11231&accname=Dartmouth+College&checksum=BA23F3DFCBB767E64F1D81C2C7CE372C>

Optional Reading: Wheeler DJ. Making Sense of Data. Chapters 16, pp. 263-284.

- Alemi F, Sullivan T. Tutorial on risk-adjusted X-bar charts: applications to measurement of diabetes control. *Quality Management in Health Care*. 2001; 9(3): 57-65. (available on reserve in Dana)

Laboratory: Project Lab #2

- *Aim:* Further develop your class project.
  - *Assignment:* 1) Link your data to the process from which it is derived.  
2) Present the analysis plan for your data.  
3) Develop a dummy data display for your measures.  
4) Comment on any initial analyses or insights you have.
- On this day, the group must have a copy of your data set to review with your group's coach. If you do not have a data set by this date, you may be asked to switch project topics to ensure adequate data to complete the assignment.

**Week 5 (2/6): Additional Types of Control Charts, Part 2 & Dealing with Confounding in Studying Variation**

Learning Objectives:

- Build on existing knowledge of p-charts
- Review the np-, c- and u-types of control charts.
- Understand which chart should be used for which measure.
- Review the issues relevant to confounding.
- Discuss methods to use to minimize the effects of confounding.

Readings: Carey RG. Improving Healthcare with Control Charts. pp. 19-23, 71-94.

Coursepack:

- O'Rourke DJ, Malenka DJ, Olmstead EM, Quinton HB, Sanders JH Jr, Lahey SJ, Norotsky M, Quinn RD, Baribeau YR, Hernandez F Jr, Fillingner MP, O'Connor GT. Improved in-hospital mortality in women undergoing coronary artery bypass grafting. Northern New England Cardiovascular Disease Study Group. *Ann Thorac Surg*. 2001;71:507-11.  
[http://www.sciencedirect.com/science?\\_ob=ArticleListURL&\\_method=list&ArticleListID=499118035&\\_sort=d&view=c&acct=C000022698&version=1&urlVersion=0&userid=4257664&md5=6b5c618942ea7b9ec94e6e388c7f6b96](http://www.sciencedirect.com/science?_ob=ArticleListURL&_method=list&ArticleListID=499118035&_sort=d&view=c&acct=C000022698&version=1&urlVersion=0&userid=4257664&md5=6b5c618942ea7b9ec94e6e388c7f6b96)
- Shahian DM, Williamson WA, Svensson LG, Restuccia JD, D'Agostino RS. Applications of statistical quality control to cardiac surgery. *Ann Thorac Surg*. 1996;62:1351-1359.  
[http://www.sciencedirect.com/science?\\_ob=ArticleListURL&\\_method=list&ArticleListID=499118809&\\_sort=d&view=c&acct=C000022698&version=1&urlVersion=0&userid=4257664&md5=b9a07f04367025b7c87269a393ea31a1](http://www.sciencedirect.com/science?_ob=ArticleListURL&_method=list&ArticleListID=499118809&_sort=d&view=c&acct=C000022698&version=1&urlVersion=0&userid=4257664&md5=b9a07f04367025b7c87269a393ea31a1)
- Lagasse RS, Steinberg ES, Katz RI, Saubermann AJ. Defining quality of perioperative care by statistical process control of adverse outcomes. *Anesthesiology*. 1995;82:1181-1188.  
<http://gateway.ut.ovid.com/gw1/ovidweb.cgi>

Optional Readings: Wheeler DJ. Making Sense of Data. Chapters 13-15, pp. 199-262.

- Benneyan JC. Statistical quality control methods in infection control and hospital epidemiology, Part I: Introduction and basic theory. *Infect Control Hosp Epidemiol*. 1998;19:194-214. (available on reserve in Dana)
- Alemi F, Oliver DW. Tutorial on risk adjusted P-charts. *Quality Management in Health Care*. 2001;10:1-9. (available on reserve in Dana)

Laboratory: Clinical Data Lab

- *Aim:* Analyze a dataset of measures from patients who had CABG surgery.
- *Assignment:* 1) Make p-charts using Excel pivot tables.  
2) Stratify data to look for different effects over time.  
3) Interpret the data and summarize your thoughts.

## Week 6 (2/13): Drilling Down into Aggregate Data and Analysis of Means

### Learning Objectives:

- Understand this technique for analyzing data.
- Discuss how to use this in health care.

Readings: Carey RG. Improving Healthcare with Control Charts. pp. 29-52, 111-130.

### Coursepack:

- Niles N. Tarbox G. Schults W. Swartz W. Wolf E. Robb J. Plume S. Nelson EC. Nugent W. Using qualitative and quantitative patient satisfaction data to improve the quality of cardiac care. Joint Commission Journal on Quality Improvement. 1996;22:323-35.  
**Not available electronically. Please see handout.**
- Balestracci D, Barlow JL. Statistical stratification: analysis of means. In Quality Improvement: Practical Applications for Medical Group Practice (2<sup>nd</sup> Ed). Center for Research in Ambulatory Health Care Administration: Englewood, CO, 1996; pp. 151-189.  
**Not available electronically. Please see handout.**

Laboratory: Analysis of Means

- *Aim:* Analyze a dataset using the method of analysis of means.
- *Assignment:* 1) Choose two variables from previous datasets.  
2) Perform an appropriate analysis of means on those variables.  
3) Interpret the data and summarize your thoughts.

## **Week 7 (2/20): Patient Safety and Analysis of Rare Events**

### **Learning Objectives:**

- Discuss applications in health care related to patient safety.
- Review the process of measurement development and display.
- Understand the use of g charts.

### **Readings:** Cousepack:

- Benneyan JC. Number-between g-type statistical quality control charts for monitoring adverse events. Health Care Management Science. 2001;4:305-318. <http://proquest.umi.com/pqdweb?index=3&did=352534271&SrchMode=3&sid=1&Fmt=10&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=116499273&clientId=4347&aid=1>
- Wall RJ. Ely EW. Elasy TA. Dittus RS. Foss J. Wilkerson KS. Speroff T. Using real time process measurements to reduce catheter related bloodstream infections in the intensive care unit. Quality and Safety in Health Care. 2005;14:295-302. <http://qshc.bmj.com/cgi/reprint/14/4/295>
- Mills PD. Weeks WB. Surott-Kimberly BC. A multihospital safety improvement effort and the dissemination of new knowledge. Joint Commission Journal on Quality and Patient Safety. 2003;29:124-33. <http://docserver.ingentaconnect.com/deliver/connect/jcaho/15537250/v29n3/s3.pdf?expires=1164921569&id=33751495&titleid=11231&accname=Dartmouth+College&checksum=1B542AEE8DFAE3BF8786973562710C85>
- Srinivasan A. Wolfenden LL. Song X. Mackie K. Hartsell TL. Jones HD. Diette GB. Orens JB. Yung RC. Ross TL. Merz W. Scheel PJ. Haponik EF. Perl TM. An outbreak of Pseudomonas aeruginosa infections associated with flexible bronchoscopes. New England Journal of Medicine. 2003;348:221-7. <http://content.nejm.org/cgi/reprint/348/3/221.pdf>

### **Laboratory:** Rare Events

- *Aim:* Analyze rare event data using a g-chart.
- *Assignment:* 1) Pick a rare event variable to analyze.  
2) Create a g-chart for your variable.  
3) Interpret the data and summarize your thoughts.

## **Week 8 (2/27): Using Registries to Improve Patient Care**

### Learning Objectives:

- Understand how registries can be constructed and used in monitoring and improving care.
- Consider a method for real-time assessment of outcomes in transplant surgery (CUSUM).

Readings: Carey RG. Improving Healthcare with Control Charts. pp. 159-183.

### Coursepack:

- Axelrod DA, Guidinger MK, McCullough KP, Leichtman AB, Punch JD, Merion RM. Association of center volume with outcome after liver and kidney transplantation. *Am J Transplantation*. 2004;4:920-927.  
<http://www.blackwell-synergy.com/doi/full/10.1111/j.1600-6143.2004.00462.x>
- Axelrod DA, Guidinger MK, Metzger RA, Wiesner RH, Webb RL, Merion RM. Transplant center quality assessment using a continuously updatable, risk-adjusted technique (CUSUM). *Am J Transplantation*. 2006;6:313-323.  
<http://www.blackwell-synergy.com/doi/full/10.1111/j.1600-6143.2005.01191.x>
- Grigg OA, Farewell VT, Spiegelhalter DJ. Use of risk-adjusted CUSUM and RSPRT charts for monitoring in medical contexts. *Statistical Methods in Medical Research*. 2003;12:147-170.  
<http://smm.sagepub.com/cgi/reprint/12/2/147>
- Ferguson TB Jr. Peterson ED. Coombs LP. Eiken MC. Carey ML. Grover FL. DeLong ER. Society of Thoracic Surgeons and the National Cardiac Database. Use of continuous quality improvement to increase use of process measures in patients undergoing coronary artery bypass graft surgery: a randomized controlled trial. *JAMA*. 2003;290:49-56.  
<http://jama.ama-assn.org/cgi/reprint/290/1/49>

## Week 9 (3/6): Beyond Data Comparison to Benchmarking

### Learning Objectives:

- Enhance our understanding of what a benchmark measure really is.
- Critique examples of common benchmarks.

Readings: Carey RG. Improving Healthcare with Control Charts. pp. 101-111.

### Coursepack:

- Mohr JJ, Mahoney CC, Nelson EC, Batalden PB, Plume SK. Improving health care, part 3: clinical benchmarking for best patient care. *Joint Comm J Qual Improve*. 1996;22:599-616.  
**Not available electronically. Please see handout.**
- Weissman NW, Allison JJ, Kiefe CI, Farmer RM, Weaver MT, Williams OD, Child IG, Pemberton JH, Brown KC, Baker CS. Available benchmarks of care: the ABC<sup>TM</sup>s of benchmarking. *Journal of Evaluation in Clinical Practice*. 1999;5:269-281.  
<http://www.blackwell-synergy.com/toc/jep/5/3>
- Kiefe CI, Allison JJ, Williams OD, Person SD, Weaver MT, Weissman NW. Improving quality improvement using achievable benchmarks for physicians: a randomized controlled trial. *JAMA*. 2001;285:2871-2879.  
<http://jama.ama-assn.org/cgi/reprint/285/22/2871>

Laboratory: Benchmarking

- *Aim:* Analyze data using the Achievable Benchmarks of Care method
- *Assignment:* 1) Pick two measures to analyze.  
2) Use the ABC method to calculate a benchmark of care.  
3) Interpret the data and summarize your thoughts.

## **Week 10 (3/13): Developing Measures for Strategic Use and Accountability**

### Learning Objectives:

- Develop an understanding for how an organization can develop and use measure that enhance its mission and address public accountability.
- Discuss the challenges to using these approaches in practice.
- Hear about the results from student projects.

Readings: Carey RG. Improving Healthcare with Control Charts. pp. 131-158.

### Coursepack:

- Britto MT, Anderson JM, Kent WM, Mandel KE, Muething SE, Kaminski GM, Schoettker PJ, Pandzik G, Carter LA, Kotagal UR. Joint Commission Journal on Quality and Patient Safety. 2006;32:541-548.  
<http://www.ingentaconnect.com/content/jcaho/jcjq/2006/00000032/00000010/art00002>

**Final exam distributed at the end of class.**

**Week 11 (3/20): Final Exam Due at 2 p.m.**