This is a sample of the instructor materials for *High-Reliability Healthcare: Improving Patient Safety and Outcomes with Six Sigma*, second edition, by Robert Barry, Amy C. Smith, and Clifford E. Brubaker.

The complete instructor materials include the following:

- An instructor's guide with detailed lecture notes
- Corresponding PowerPoint slides suitable for 15 three-hour sessions
- Various resources, including cases, articles, a slide show, and an emergency room simulator

This sample includes the lecture notes and PowerPoint slides for Chapter 2, "Six Sigma."

If you adopt this text, you will be given access to the complete materials. To obtain access, e-mail your request to hapbooks@ache.org and include the following information in your message:

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Session Two: Six Sigma

Review:

1. What did Chassin and Loeb have to say?
2. Life expectancy at birth depends on public health and sanitation; life expectancy at age 65 depends on medical care. What did you find?
3. Does America have a lot of acute care beds for the population? Compared to … ?
4. What else?

What Is Quality?

Crosby (page 12) says, “Quality is meeting the specification.”

That’s a good place to start. But is that enough? Suppose a bolt and a nut both meet spec but just barely. Trouble lurks. Suppose a batch of bolts are at the ragged edge. What’s the chance that one of them is in fact out of spec, even if samples from the batch pass inspection?

Think about the purpose of a specification. The purpose is to tell the stage of production that this part or component or service or delivery time or … can be relied upon. The spec is a contract between the stages of production. Failures to meet spec will be very, very rare. Maybe not zero, but very, very rare. Say a few times in a million. Otherwise, the whole system is in jeopardy.

Chart 1. Points are all within the limits. In Excel, hit F-9 to generate new data points. Repeat.

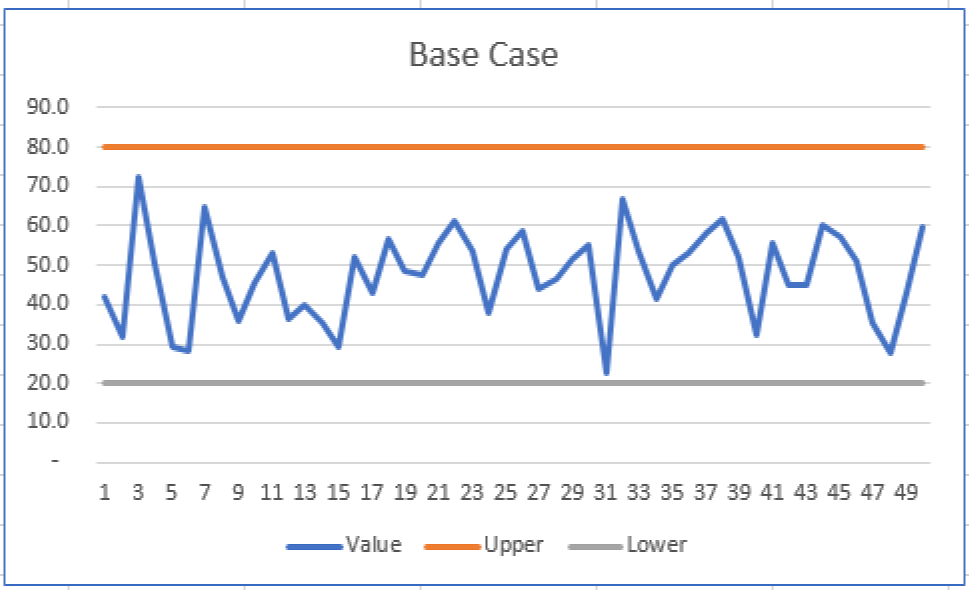


Chart 2. Same limits, but this time we have reduced the variability of the process (cut standard deviation by half). Which one do you like better? Now you can see white space between the points and the limits, the same limits we had before. Does this look like it’s more likely to succeed?

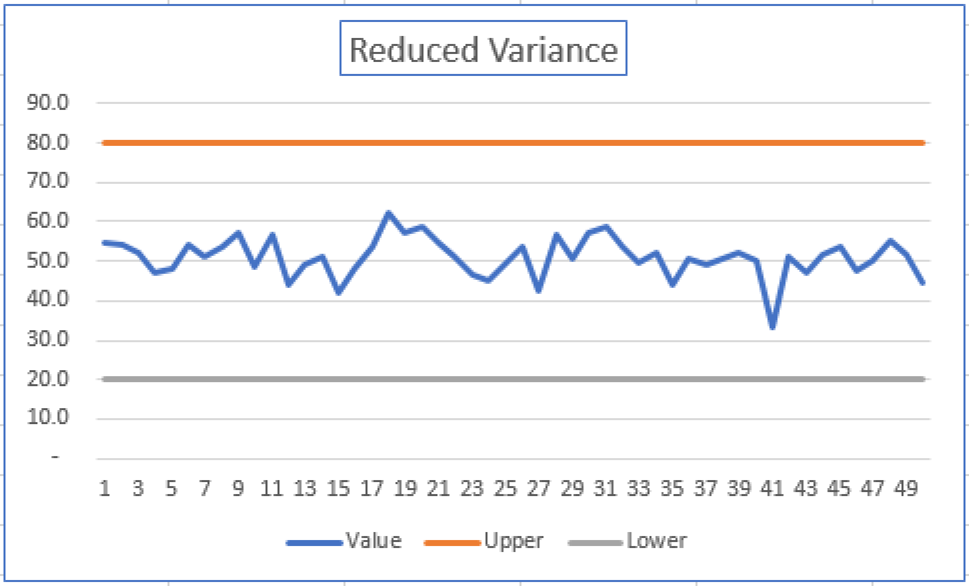
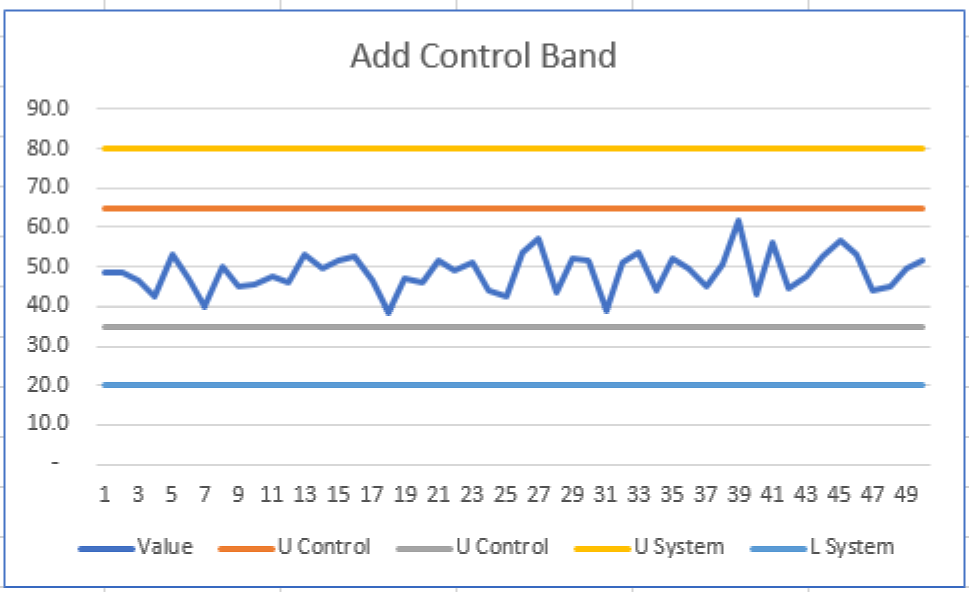


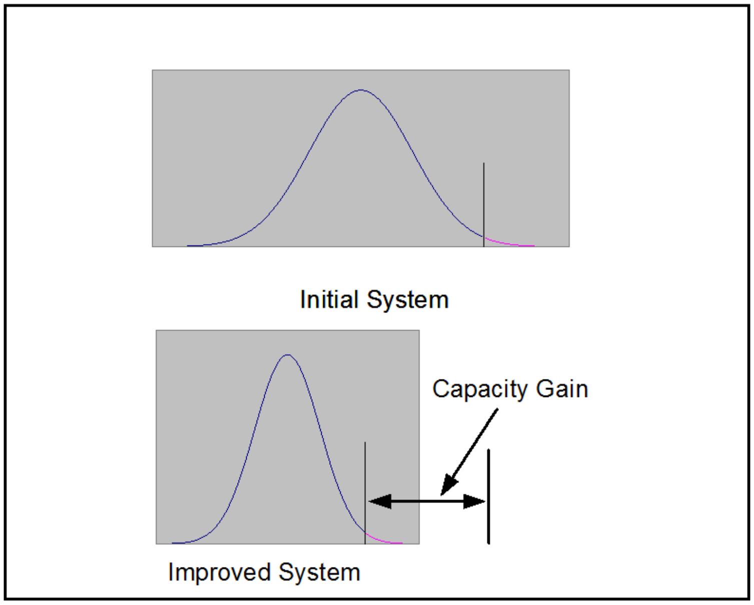
Chart 3. Okay, so we cleaned up the process, but now we have to keep the process cleaned up. So, we add lines to show that we will manage production within the tighter band. If you've read ahead, you will know this is called a Control Band with Control Limits, while the wider one is called the System Band with System limits. The System Band is the spec, the contract between stages of production. The Control Band is used by the responsible parties to make sure that there is plenty of white space between the values and the System Limits.



There is surely economic value in narrowing the System Limits, because some stage downstream has to allow for variability as wide as the System Limits on this stage of production. If process variability can be reduced even more, then the System Limits can be tightened, and notice the six-times multiplier. Tightening up on variability adds economic value. Cutting the System Limits without reducing the variability is, of course, to invite difficulties and bad final product. This needs to be understood all the way up and down the organization chart.

You'll soon see that we draw the Control Band and plus-minus three standard deviations and the System Band at plus-minus six standard deviations. Everybody uses lower-case sigma for standard deviation, so we have set the System Band and plus-minus Six Sigma. Six Sigma!

Voilà!



To sum up: Reducing variability in each stage of production, any kind of production, increases economic value. So, reduce variability.

One way to reduce variability is to get rid of frivolous sources of variability by standardizing on a method that gives good results.

Another is to reduce the error rate.

Another is to recognize when things are going awry, jump in, and correct the process.

Another is to get the workers on your side by making sure, by word and deed, that you really believe that if something goes wrong, it's never the worker's fault, it's the system's fault. The system includes machinery, communications, the workplace, and worker training. If a worker is making mistakes, then the worker's training is insufficient and needs to be remedied, or perhaps the workplace needs to be improved.

We speak here of inadvertent error, not sabotage.

Finally, we have to bear in mind that every system has irreducible amount of variability. Maybe it's wear and tear, maybe it's the state of the art. Don't cut System Limits below what the intrinsic variability requires.

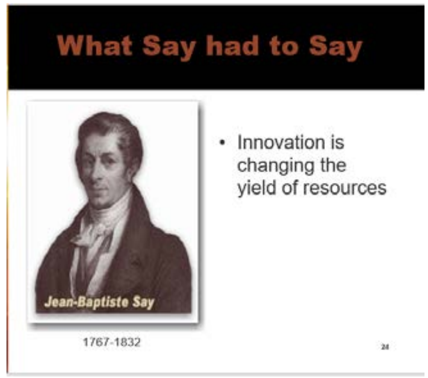
Motorola

While scientific management started a long time ago, Six Sigma as a specific program with specific goals and measures was started by Bob Gavin, president of Motorola. Gavin told his management: We need to do a lot better on first-time-through yield and on cycle time. What level are we at? Well, maybe three sigma. Okay, make it double. Make it Six Sigma.

It's good to be boss.

Innovation

All this involves change. Innovation. Why? Well, Jean-Baptiste Say, whom you'll remember from your economics class as the oracle of Say's Law (production creates its own demand), said that innovation is changing the yield of resources. That's what management is supposed to do, isn't it? So that's why you're here.



Quality, Quality Programs, Culture

Read: Barry, Case of the Yai Yai Yai

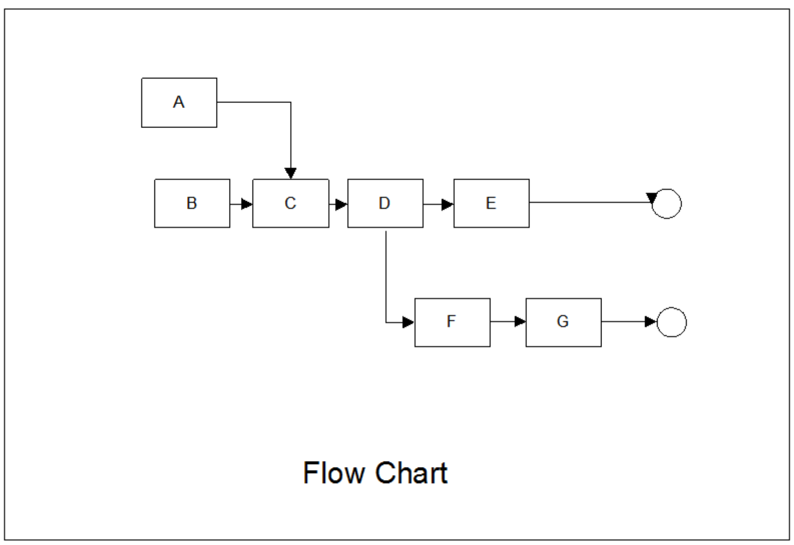
Discussion: Hospitals are always having quality improvement programs, one after the other. Why?

Various departments, often the Emergency Department, launch improvement programs on their own. Sounds like a good idea. What do you think?

Workflow

We will spend a good part of the course talking about workflow. As you have read, Motorola set out to make big improvements in yield (good results divided by total results) and in cycle time (parts in the door to finished goods out the door). Yield and workflow are deeply intertwined. You need to be aware of both. That's why this course is good for you.

Here's a trivial flow chart. Several stages of production, with hand-over from one to the next. When we talk about yield and cycle time, we talk of the entire system. To get high yield overall, we need to get very high yield at each stage. Figure that out for yourself. If we want a low-variability cycle time, we need really low-variability cycle time at each stage and at each hand-off.



Each little box represents a stage of production, with something being done to hand forward to the next stage. We are interested in the variability within each box. We are also interested in the communications between boxes, because lots of things can go wrong at the interface. Indeed, one of the primary questions will be, Can we reduce the number of hand-offs?

Real flow charts have more than one flow path, with more than one input per box, and maybe more than one output per box. Even so, at the ground level, we have units of production and interfaces. We are interested in both.

Other Factors

The discussion so far ignores errors and delays that arise in reading the values and logging the values. Sometimes every data point is measured and logged; sometimes only a sample is measured. How do you decide how many samples are required? Remember, the point of data logging is to be confident the process is working, not that each datum is within spec. If you decide to allow something for measurement and logging error, how do you change the chart? Suppose getting the reading takes some time, as with a lab culture that takes 24 hours. What do you do?

Suppose the staff member observes that logged points are showing up outside the Control Band. What to do? Suppose a staff member observes that the logged points seem to be drifting upward, still within the Control Band. What to do? (Hint: This is known as "stopping the line" in the automotive and some other industries. Who should be allowed to stop the line? In surgery?)

For Next Time

Find the cost of healthcare in the USA and in some other countries.

Find out what the USA pays doctors. Ditto other countries. Ditto nurses.

Figure out how many heart pacemakers are enjoyed by American elderly and by elderly in comparable countries. Ditto artificial hips.

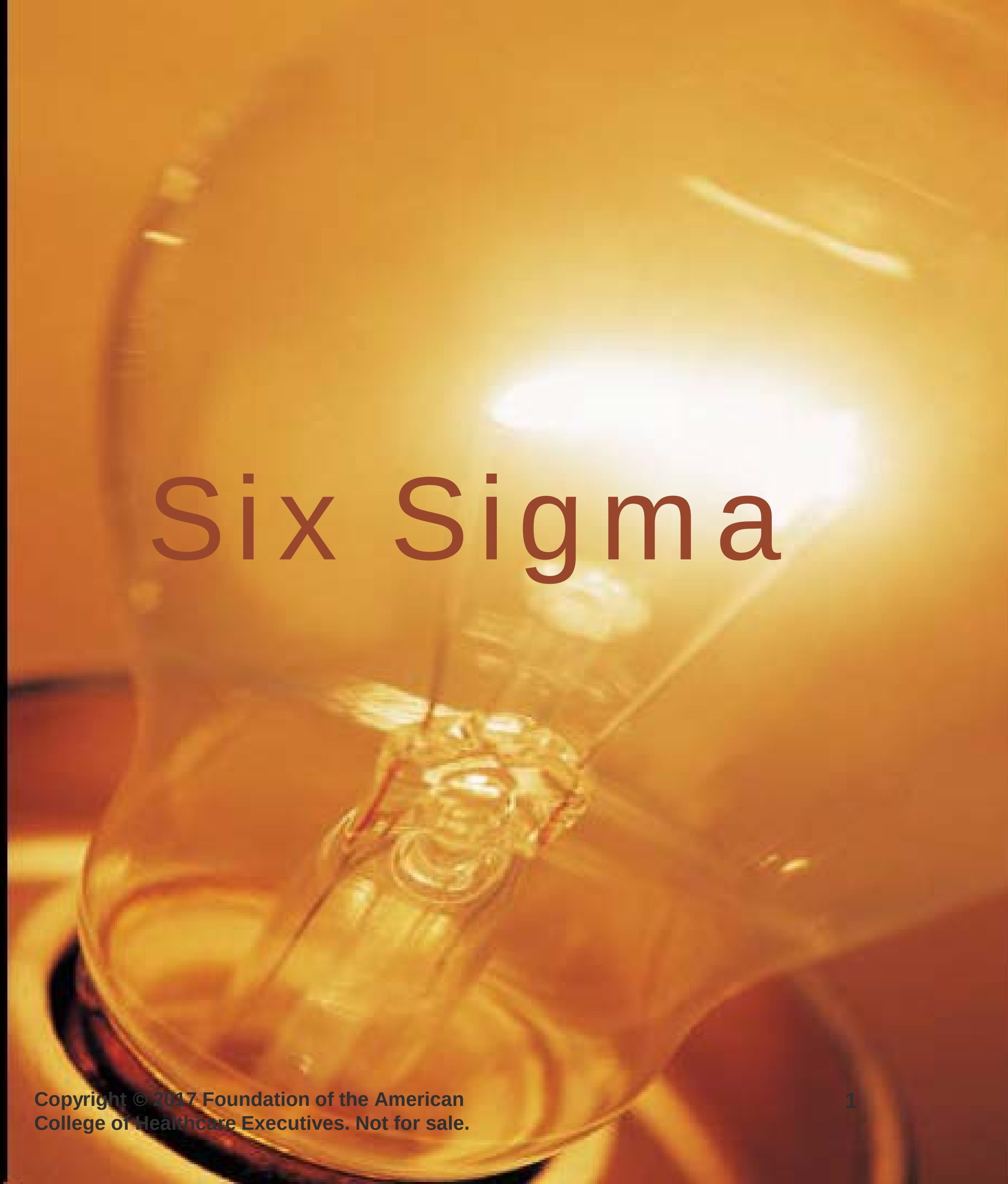
Hint: Differences in healthcare cost can be explained by higher American salaries for healthcare professionals (do you want your surgeon to be worrying about her mortgage payment?) and by quality-of-life health services (do you want grandma to be bedfast if she rolls over in bed and breaks a hip?).

Work Case 1 and Case 2 for review of basics. Text pages 177 *et seq*. These cases are set up for Excel because Excel is generally available. There are plenty of good statistics applications that provide better mechanics.

Find something on the Toyota Production Method and consider differences, if any, between Toyota Production Method and Six Sigma.

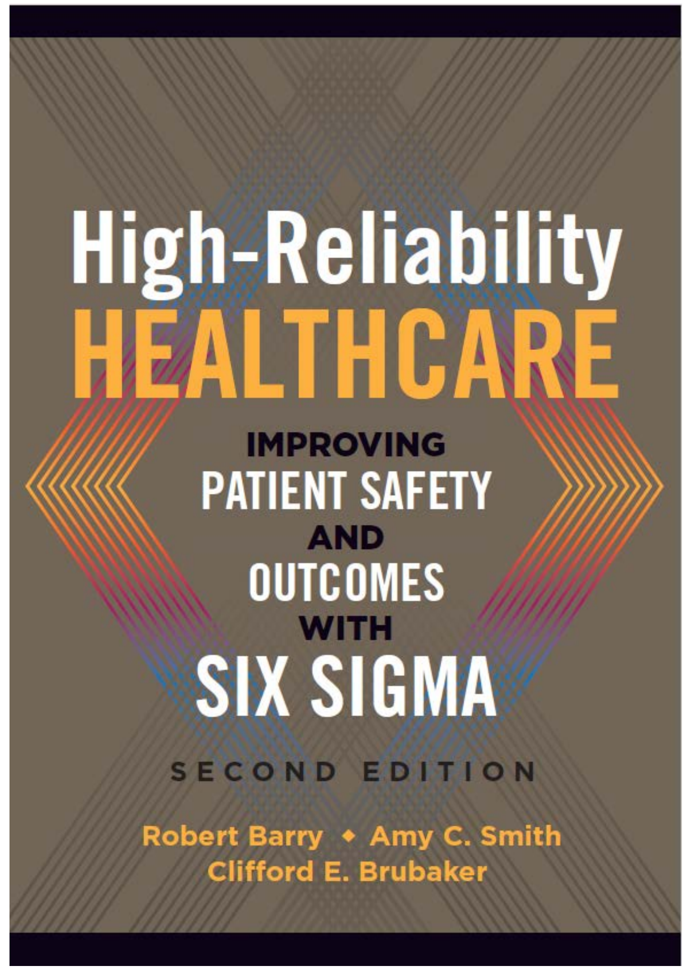
We'll take up "continuous improvement" and "big projects only" later on. What are your thoughts?

Text: Chapter 3.

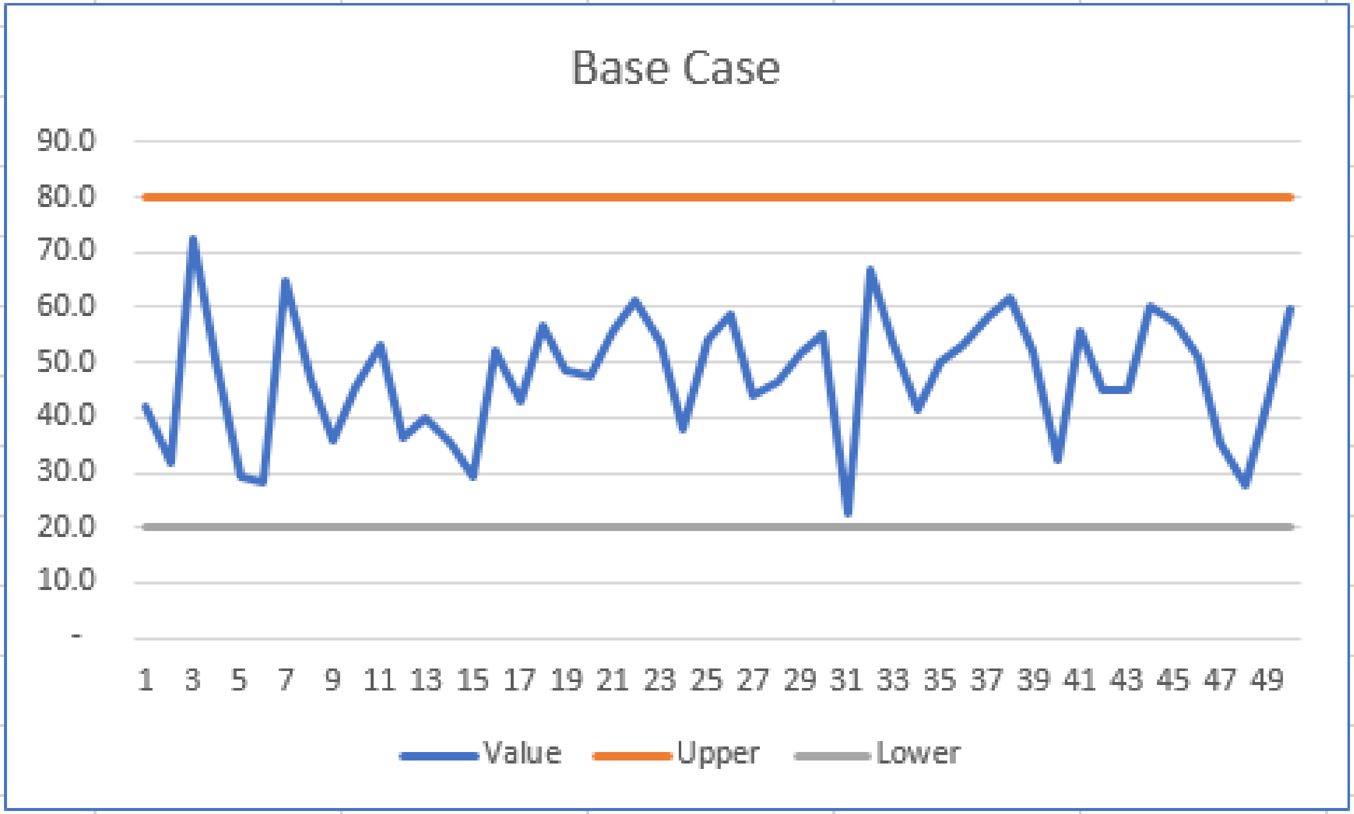


Six Sigma

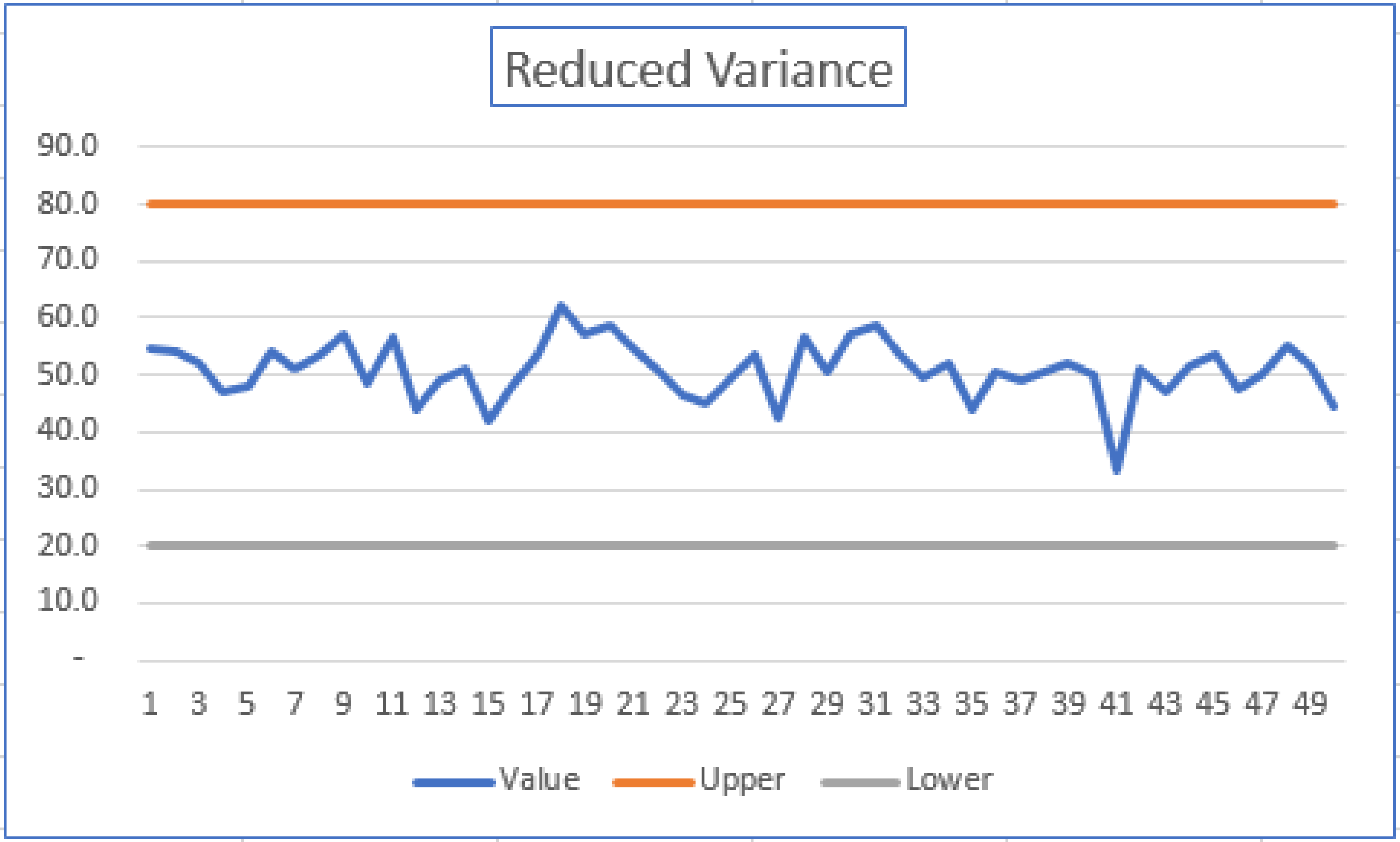
Our Text


High-Reliability
HEALTHCARE
IMPROVING
PATIENT SAFETY
AND
OUTCOMES
WITH
SIX SIGMA
SECOND EDITION
Robert Barry ◆ Amy C. Smith
Clifford E. Brubaker

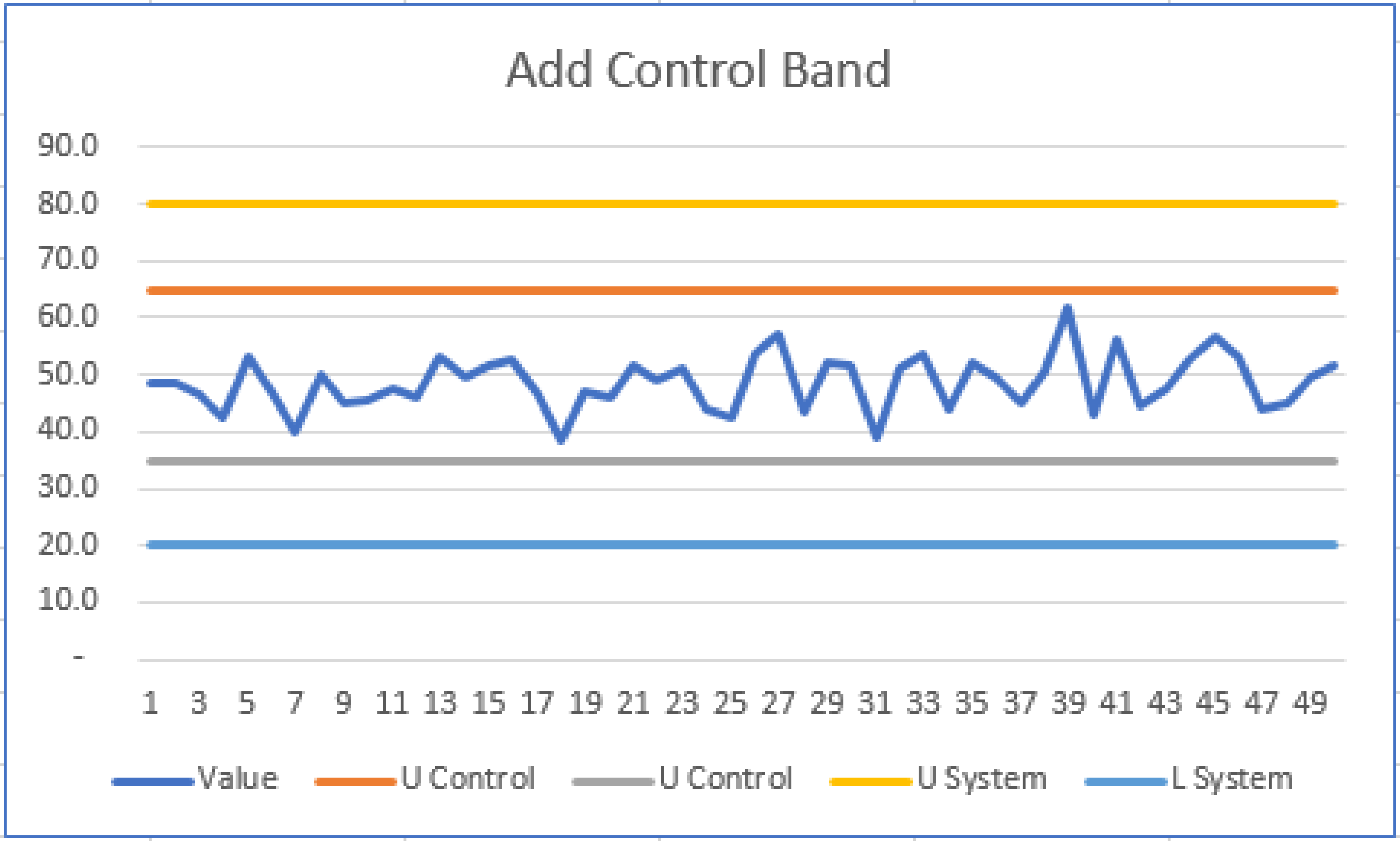
Base Case


Base Case
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
-
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Value
Upper
Lower

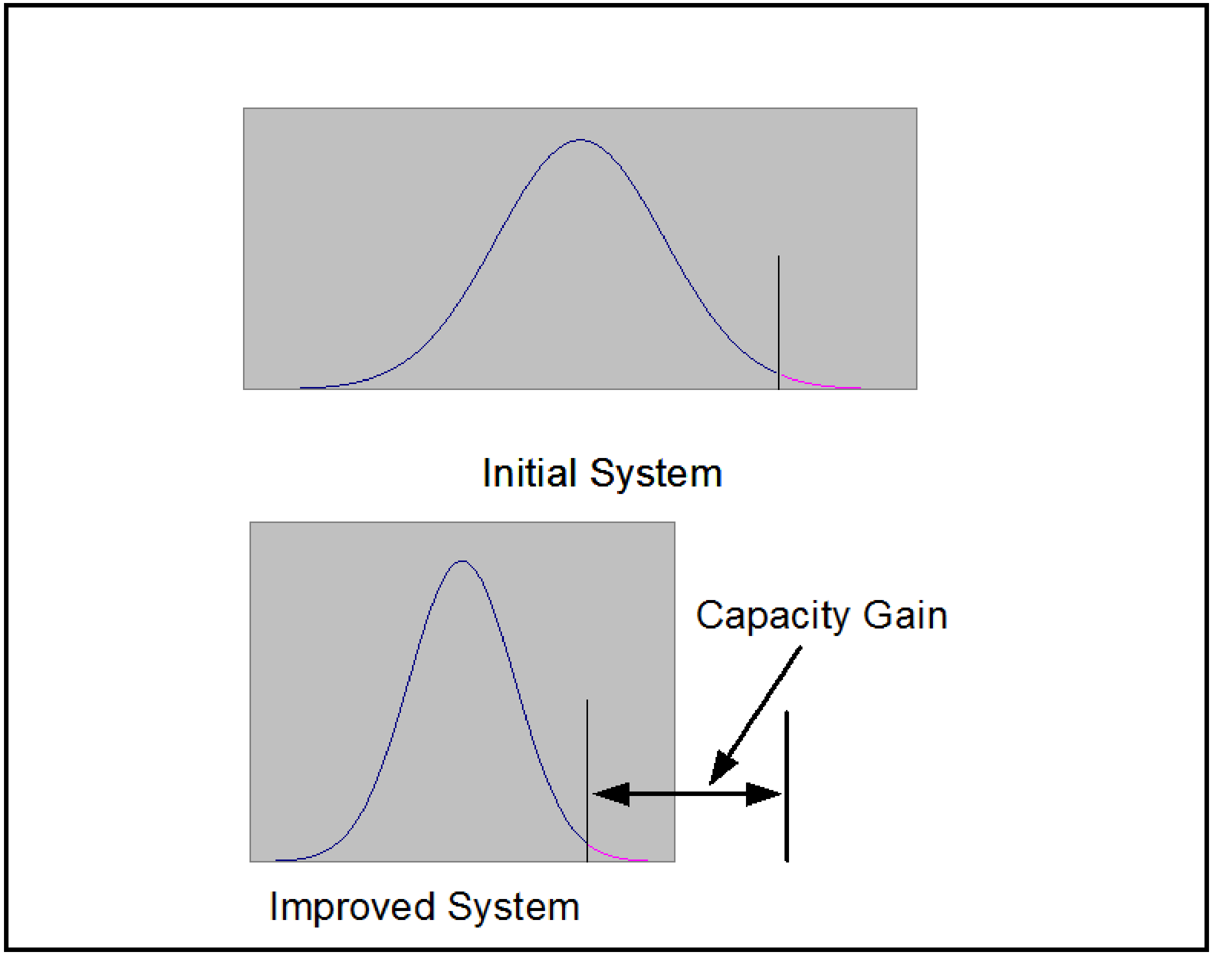
Reduced Variance



Add Control Band



Capacity Gain



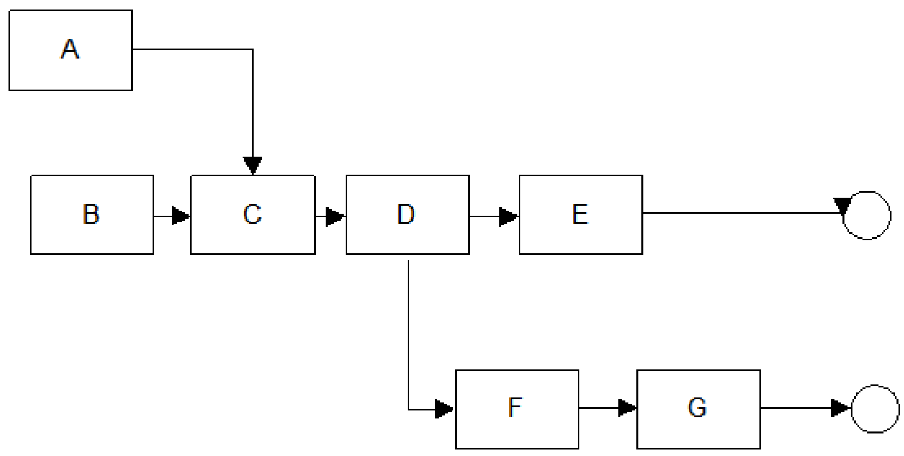
Robert Galvin

- We need to be twice as good as we are.
- We're at 3σ?
- Then we need to be at 6σ.
- Do it!

Jean-Baptiste Say

- Innovation is changing the yield of resources.

Flow Chart



Flow Chart