AGAINST ALL ODDS
EPISODE 23 – "CONTROL CHARTS"
TRANSCRIPT

FUNDER CREDITS

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INTRO

Pardis Sabeti
Hi, I'm Pardis Sabeti and this is *Against All Odds*, where we make statistics count.

Statistical inference is a powerful tool. Using relatively small amounts of sample data we can figure out something about the larger population as a whole. Lots of businesses rely on this principle to improve their products and services.

Management theorist and statistician W. Edwards Deming was among the first to champion the idea of statistical process management.

> **W. Edwards Deming**
> My aim is transformation of American style of management. It'll have to take place. And companies that don't make the change in style will not be here in a few years.

Pardis Sabeti
Deming was an American himself, but found the most receptive audience to his management theories in Japan. After World War II, Japanese industry was shattered. Rebuilding was a daunting challenge, one that Japanese business leaders took on with great determination.

In the decades after the war, they transformed the phrase "Made In Japan" from a stamp of inferior, cheaply-made goods to a sign of quality respected the world over. Deming's emphasis on long-term thinking and continuous process improvement were vital in bringing about the so-called "Japanese Miracle."

> **W. Edwards Deming**
> I told the Japanese that they would capture markets within five years the world over, that they would take their place alongside prosperous nations. They have done it. They have done it.

Pardis Sabeti
Deming criticized American managers for their lack of understanding of statistics. But as time went on – and competition from Japan grew! – companies in the U.S. eventually embraced Deming's ideas on statistical process control, too.

Now his principles of total quality management are an integral part of American business, helping workers uncover problems and produce higher quality goods and services.

In statistics, a process is a chain of steps that turns inputs into outputs. That could be anything from the way a factory turns raw iron into a finished bolt… to the way you turn raw ingredients into a hot dinner. Statisticians say a process

that's running smoothly, with its variables staying within an expected range, is in control.

Deming was adamant that statistics could help in understanding a manufacturing process and identifying its problems – or when things were out of control. He advocated the use of control charts as a way to monitor whether a process is in or out of control. This technique is widely used to this day – in factories, and also here at Quest Diagnostics's lab.

Quest performs medical tests for healthcare providers. Everyday worldwide they process half a million diagnostic tests on blood, bodily fluids and tissue.

> **Karen Chaudiere**
> In our business of doing lab work, which is a huge component to diagnosing, treating people's health, we have an obligation and I take it very seriously, to continually improve those processes, to make it shorter, to bring those tests closer to the people, to make sure their results are absolutely accurate, and get better and better and better at that. Because people's lives are at stake.

Pardis Sabeti
At Quest, a patient's blood sample is the input of the process and the test result is the output. A courier picks up specimens and transports them to the processing lab, where they're sorted by time of arrival and urgency of test. Technicians verify each specimen and confirm the doctor's orders. Then they're barcoded and ready to be passed on. Quest's Seattle processing lab aimed to get all specimens logged in and ready by 2 A.M., so the samples could move on to the technical department for analysis.

> **Cheryl Millet**
> If we don't meet our goal, then it creates a domino effect, which if we're late, they're late. And it affects technical. Technical won't turn the results out on time and then Client Services will most likely get phone calls from our clients complaining about not getting their specimen results on time.

Pardis Sabeti
Until a few years ago, they were rarely meeting that 2 A.M. goal… and their lateness was leading to poor customer and employee satisfaction, and wasted corporate resources.

Enter Statistical Process Control! To figure out how big a problem they were up against, Quest needed to know where the process stood at present. How close were they to hitting that 2 A.M. target and how much did finish times vary?

All processes have variation. Common Cause Variation is due to the day-to-day factors that influence the process. In this case it could be things like a printer

running out of paper and needing to be refilled, or an ill worker calling in sick. It's the normal variation in a system.

Processes are also susceptible to Special Cause Variation – sudden, unpredictable events that can throw a wrench into the works. That's something like a citywide blackout that shuts down the lab's power, or a crash on the highway that keeps the samples from being delivered to the lab. Quest needed to figure out how their process was running on a day-to-day basis when they were only up against Common Cause Variation.

Based on six months of finish time data, Quest created a control chart, a graphic way to keep track of variation in finish times. The center line is the target finish time. These control limits are set three standard deviations above and below the center line. Remember in a normal distribution, 68% of your data is within one standard deviation of the mean, 95% is within two standard deviations, and 99.7% is within three standard deviations. Quest assumed that their nightly finish times were normally distributed. The data points are the finish times that they tracked. Using this chart allowed Quest to figure out when their process had been disturbed and gone out of control, or was heading that way. One dead giveaway that the finish times are out of control is if a point falls outside the control limits. That should only happen 0.3% of the time, if everything is running smoothly.

> **Karen Chaudiere**
> There's other ways that you can look at the data that begin to be – I like to use the word "suspicious." That we have this many points on this side of the center line, for instance, or there's some, a pattern that is more than random. If it's random, common cause variation, it will look like that. But if it's something that looks like a pattern, you start to investigate it. And you say: "Is there something that's going on here? Is there, has there been a change in the process?"

Pardis Sabeti
Mapping finish times on the control chart helps monitor the process, and alerts techs right away if something has been disturbed. Then they can track down and address the cause immediately.

Another way the control chart helped Quest improve efficiency was by revealing some of the causes of variation in the process, which the team could then address.

> **Cheryl Millet**
> We actually remodeled the entire department. We didn't have pods before, the staffing was changed. We have the processors, which I call the production staff. And then we have the support services, which is the bin sort and pre-sort people that walk around and take care of all of that for

us. And now we have a lead stationed at the head of each pod, and they're right there when people are working and they can answer the questions right away instead of standing in line.

Pardis Sabeti
These sorts of changes brought the mean finish time much closer to the 2 A.M. target, and the remaining variation clustered more tightly around the mean. The days of wildly erratic finish times ranging from 1:15 to 6 A.M. were gone.

Karen Chaudiere
Once you have fundamentally improved the process and changed it, that's when you recalculate the control limits. The process happens, and the control limits are a function of the new level of quality that you've created. They're calculated from the data.

Pardis Sabeti
Now the process of specimen testing runs much more smoothly… and the updated control chart helps keep it that way. For *Against All Odds*, I'm Pardis Sabeti. See you next time!

PRODUCTION CREDITS

Host – Dr. Pardis Sabeti

Writer/Producer/Director – Maggie Villiger

Associate Producer – Katharine Duffy

Editor – Seth Bender

Director of Photography – Dan Lyons

Sound Mix – Richard Bock

Animation – Jason Tierney

Title Animation – Jeremy Angier

Web + Interactive Developer – Matt Denault / Azility, Inc.

Website Designer – Dana Busch

Production Assistant – Kristopher Cain

Teleprompter – Sue Willard-Kiess

Hair/Makeup – Amber Voner

Additional Footage and Stills
- The Deming Institute
- Coast Learning Systems
- The U.S. National Archives and Records Administration, ARC 642010
- iStock/feidro
- Pond5/koko_tewan
- Pond5/Michael A. Gruich
- Pond5/LBLSIBERIA

Music
DeWolfe Music Library

Based on the original Annenberg/CPB series *Against All Odds*,
Executive Producer Joe Blatt

Annenberg Learner Program Officer – Michele McLeod

Project Manager – Dr. Sol Garfunkel

Chief Content Advisor – Dr. Marsha Davis

Executive Producer – Graham Chedd

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