AGAINST ALL ODDS
EPISODE 6 – "STANDARD DEVIATION"
TRANSCRIPT

FUNDER CREDITS

Funding for this program is provided by Annenberg Learner.

INTRO

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

Rainy days can really influence the ambiance of a city – and the reputation of its weather. So are you surprised to hear that Portland, Oregon – drizzly and grey by reputation – actually has around the same average monthly precipitation as Montreal, Canada? Over the course of the year, Portland sees about 3.6 inches of precipitation per month while Montreal gets about 3.4 inches. Those averages are pretty darn close, but the cities' rainy reps are totally different – and for good reason, as you can see on these plots of precipitation over the course of a year. The averages of Portland and Montreal's monthly precipitation rates are nearly identical, but the cities have very different climates.

We've hit on a case where a measure of center doesn't provide all the information we need. The averages or means are about the same for the two cities, but obviously their weather patterns are different. Montreal's precipitation is relatively consistent, measuring between two and four inches monthly throughout the year. Portland's precipitation is much more variable – concentrated in the winter months, which can get almost seven inches of rain, while summer months get less than an inch.

From month to month, Montreal has less variation – or spread – than Portland, but the two cities' mean precipitation figures are basically identical. You can see why in statistics it's important to know both a distribution's measure of center and its spread in order to get a full picture of the data.

Let's look at another example to learn more about how statistics can provide a numerical way to describe that spread, or variability.

> **Wing Lam**
> Wahoo's Tacos started out in Southern California as a place where surfers could hang out after they went surfing. Wahoo's is a place that you went to refuel after you did the activity.

Pardis Sabeti
Wing Lam and his two brothers founded their first Wahoo's as a single taco shop on the beach. Now they have more than 50 Wahoo's Fish Tacos restaurants in their chain. No two outlets are identical. They all differ in size, location and staffing, and each restaurant has a unique pattern of sales.

As the Wahoo's business has grown, the Lams have learned to keep a close watch on the sales figures coming in from each branch. Knowing what to expect

based on how busy each month has been in the past lets managers plan inventory orders and staff schedules appropriate to each location.

One of the most successful Wahoo's today is located inland, at a shopping mall.

> **Wing Lam**
> South Coast Plaza's a great store because it's indoors, so it's relatively weatherproof, so whether it's hot or cold or anything in between, you're not going to have the variation that you would in maybe a store that would be more outdoors.

Pardis Sabeti
Here are one year's sales numbers for the South Coast Plaza restaurant, divided into four-week periods. You can see they are pretty stable from period to period, without big swings either up or down. The mean is about $130,000.

Let's compare those numbers with sales from another Wahoo's shop, located just up the coast in Manhattan Beach, only a block from the water. The mean of this Wahoo's monthly sales is about $97,000.

If we create a stemplot for the sales figures from the mall outlet and the beach outlet, we can get a visual sense of what's going on month to month. The South Coast Plaza restaurant data looks pretty symmetrical, with one outlier up at $177,000. That month of blockbuster sales represents the last four weeks of the year – the peak of the holiday shopping season, when the mall is at its busiest.

Now take a look at the stemplot for the Manhattan Beach restaurant. It's basically symmetrical, with two minor gaps. But look how much more spread out it is than the other stemplot. This store's sales vary much more widely, over a $100,000 range rather than the $70,000 range at the other store. Boxplots based on the sales figures make the variation obvious – check out the interquartile range, the distance between the top and bottom of the box. It's much bigger here than here.

Statistics lets us quantify this spread by looking at how far the observations are from their mean. You might have heard of the term standard deviation before – now let's see how to calculate it. We can start with the monthly numbers from Wahoo's' beach location.

Standard deviation measures how far the sales figures "typically" differ from the mean. We already know the mean: $97,429. If we subtract the mean from each period's sales, we see how far each observation deviates from the mean. Some of the deviations are positive and some are negative and they always all sum to zero. Squaring all the deviations makes them positive. Now we can start plugging numbers into our equation.

The sum of all the deviations squared, divided by one-less than the sample size gives us a number called the sample variance. Taking the square root of that sample variance, s^2, leaves us with *s*, the sample standard deviation. For the Manhattan Beach Wahoo's, that standard deviation is $31,075. OK… but what does that mean? You can think of it as kind of like the average amount that the observations stray from the mean.

While the mean sales at this Wahoo's Tacos are around $97,000, receipts, of course, vary from period to period. Some months are closer to the mean, and some are farther away. The typical distance from the mean is $31,000. That's what we're describing when we say "standard deviation."

The beauty of calculating the standard deviation for one store means we have a number we can compare with another store's standard deviation. That's one good way to see if this variation is high or low compared to another Wahoo's location.

We can perform the same calculation on the sales data from the South Coast Plaza restaurant… and find a much lower standard deviation, just over $17,000. This Wahoo's has a higher mean, but there's much less variation in sales.

It makes sense when you think about the environments of these two stores. At the beach, sales depend on the warm weather that brings sun and surf lovers to the shore. At the mall, sales are fairly steady all year long, and aren't really influenced by the season or climate. Both stores are valuable to the Wahoo's chain, but for different reasons.

> **Wing Lam**
> If you didn't have a store at the beach, you couldn't call yourself a surf restaurant. So obviously that's a great location to have for your core market, but it also influences the stores that are farther inland, and that's where you make the most of your money.

Pardis Sabeti
So one restaurant provides reliably strong receipts… the other provides street-cred, actually make that beach-cred!

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

Editors – Brian Truglio
– Jared Morris
– 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 – Kelly Cronin

Hair/Makeup – Amber Voner

Additional Footage
- Oregon Public Broadcasting
- Pond5/sehenswerk
- Pond5/Benjacabral
- Coast Learning Systems

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

Copyright © 2014 Annenberg Learner

FUNDER CREDITS

Funding for this program is provided by Annenberg Learner.

For information about this, and other Annenberg Learner programs, call 1-800-LEARNER, and visit us at www.learner.org.