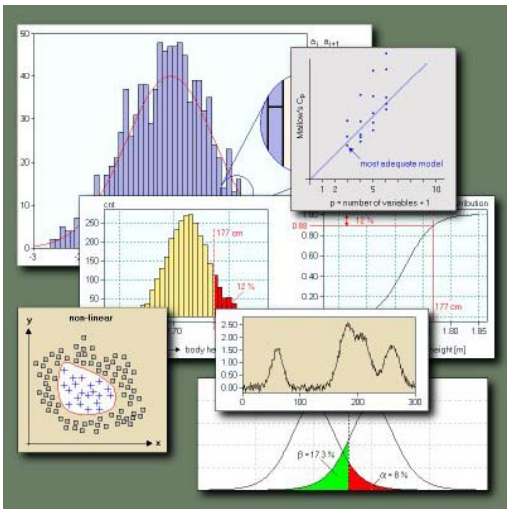
Understanding Your Variation Statistically



Miguel Ortega
Express Scripts

Welcome

It's 9 AM and you meet with your leadership to review the previous day's performance.

- Both Call Type A & Call Type B were 10% over forecast
- Call Type A was over forecast by 1 call (total for day – 10)
- Call Type B was over forecast by 600 calls (total for day – 6000)
- At face value, which one are you most concerned about, as it relates to staffing impacts?

Rather than looking and measuring variation as a percentage, we will be discussing how to analyze the relationship statistically.

Managers need to understand variation for two key reasons:

1. So they can lead others to apply statistical thinking in day to day activities
2. to apply the concept for the purpose of continuous improvement

Business Statistics

- Our session is intended to provide you with a feel for the statistical way of thinking
- This is designed as a high level overview of business statistics, and I encourage you to seek out further knowledge on this topic
- To be competitive:
  - business must design quality into products and processes
  - must facilitate a process of never-ending improvement at all stages of manufacturing and service offering
- The application of statistics in business is a science assisting you to make business decisions under uncertainties based on some numerical and measurable scales.
- Decision making process must be based on data not on personal opinion nor on belief.

Intro – Miguel Ortega

- 15 years experience in the contact center industry
  - Inbound / Outbound / Blended
  - In house and outsourced operations; B2B and B2C environments
  - Industries: Healthcare, Corporate Real Estate, Financial Services, Technology Support, Outsourcer Service Provider
  - Power user and/or administrator of Aspect eWFM, IEX, Blue Pumpkin, Witness, NICE, Avaya, Nortel, Concerto, Rockwell Spectrum, Siebel, Attendance on Demand, ADP PC Payroll, Cybernetics, Lawson HRIS, etc.
- Accomplishments:
  - BS – Information Technology (Networks & Telecommunication)
  - MBA – projected May, 2009
  - Project Management Professional
  - Bronze Star recipient for service in Operation Iraqi Freedom 07/08 – US Army
- Current position:
  - Senior Manager of Resource Management Group
  - Express Scripts (NASDAQ: ESRX) – a Pharmacy Benefits Management firm handling millions of prescriptions each year through Home Delivery and at retail pharmacies.

Agenda & Ground Rules

- Background on Statistics
- Applying fundamental business statistics concepts to call center metrics
- Using Excel to provide you with statistical data

- Interactive Session
- Please feel free to ask questions throughout the session
- Please place phones on vibrate at a minimum and feel free to step out as needed for restroom breaks and to take phone calls

Background on Statistics

- Population vs. Sample
- Measurement of Central Tendency
- Measurements of Dispersion
- Normal Distribution
- Control Charts

Population vs. Sample

- Population: A population is any entire collection of people, animals, plants or things from which we may collect data. It is the entire group we are interested in, which we wish to describe or draw conclusions about.
- Sample: is a subset that is meant to be representative of the population. For each population there are many possible samples. It is important that you carefully and completely define the population before collecting the sample, including a description of the members to be included. The larger the sample size, the better the statistical analysis; strive to have at least 30 observations for the sample you are analyzing.
- An example: We want to conduct an analysis on Call Type A
  - The population would be all of the data collected for Call Type A by half hour increment over the past three years.
  - The sample would be the analysis of daily volume for Monday's over the past 3 years

Measurements of Central Tendency

- Mean – represented by the Greek symbol μ (mu) for a population
  - The sum of the values divided by the number of non-missing values; also known as an average.
  - Most commonly used in statistics, especially when the total of all observations is of interest.
  - Example: {2, 9, 3, 5, 2, 11, 4, 8, 6, 5} $\mu = \frac{(2+9+3+5+2+11+4+8+6+5)}{10} \Rightarrow 5.5$
- Median – The median is the middle value in an ordered array of observations.
  - If there is an even number of observations in the array, the median is the average of the two middle numbers. If there is an odd number of data in the array, the median is the middle number.
  - Example: {2, 2, 3, 4, 5, 5, 6, 8, 9, 11} $median = \frac{(5+5)}{2} \Rightarrow 5$
  - Note that if the median is less than the mean, the data set is skewed to the right. If the median is greater than the mean, the data set is skewed to the left.

Measurements of Dispersion

Average by itself is not a good indication of quality. You need to know the variance to make any educated assessment. Statistical measures of variation are numerical values that indicate the variability inherent in a set of data measurements.

Quality of a data set is measured by its variability:

Larger variability indicates lower quality.

- Variance - the average of the squared deviations of each observation in the set from the arithmetic mean of all of observations.

$$v = \sigma^2 = \frac{\sum_{i=1}^{n} (x_i - \mu)^2}{n-1}$$

  - The variance is a measure of spread or dispersion among values in a data set.
  - The greater the variance, the lower the quality.
- Standard deviation - represented by the Greek symbol σ (sigma) for a population
  - Variance is hard to understand because the deviations from the mean are squared, making it too large for logical explanation. This problem is solved by working with the square root of the variance, also known as standard deviation.

Measurement of Dispersion Example

- Remember our sample data: {2, 9, 3, 5, 2, 11, 4, 8, 6, 5}
- There are 10 observations in our data: n = 10
- We had already calculated the mean to be 5.5

$$\mu = 5.5$$

- Calculate Variance

$$\boxed{v = \sigma^2 = \frac{\sum_{i=1}^{n} (x_i - \mu)^2}{n-1}}$$

$$v = \frac{(2-5.5)^2 + (9-5.5)^2 + (3-5.5)^2 + (5-5.5)^2 + \ldots + (5-5.5)^2}{(10-1)}$$

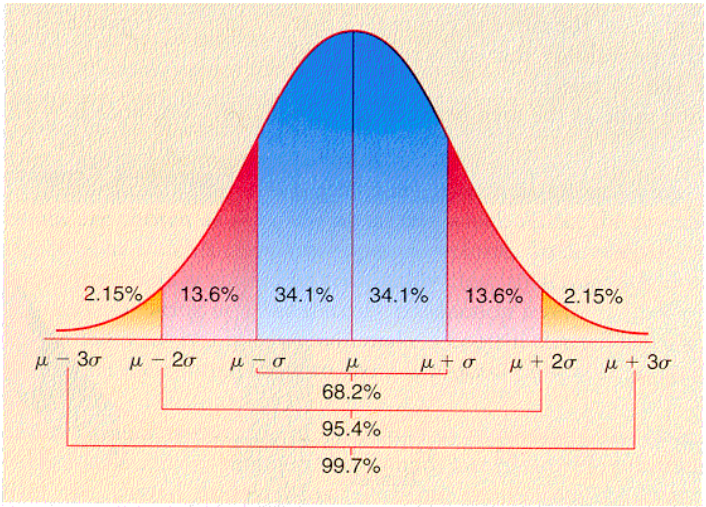
$$v = \frac{82.5}{9}$$

$$v = 9.1667$$

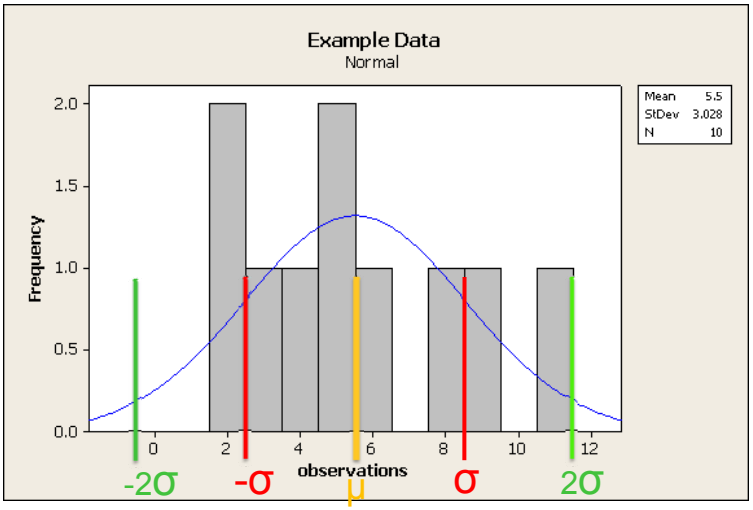
- Now we can calculate the standard deviation

$$\sigma = \sqrt{v} = \sqrt{9.1667} = 3.0275$$

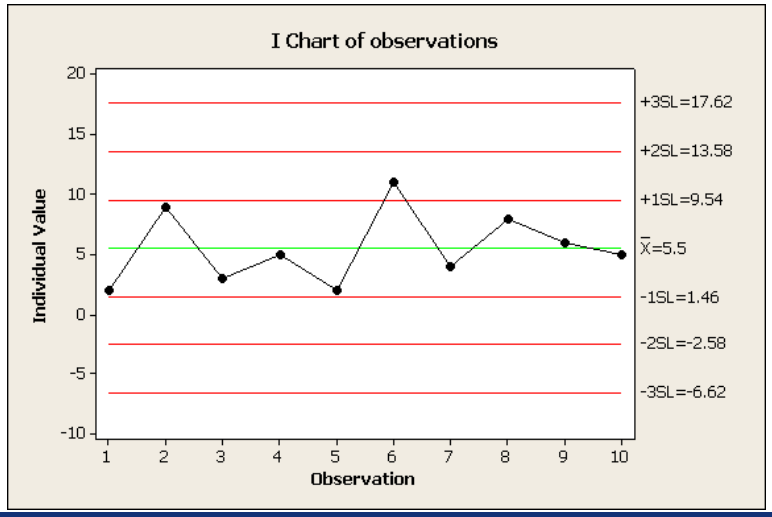
Normal Distribution



Normal Distribution
Example



Control Charts
Example

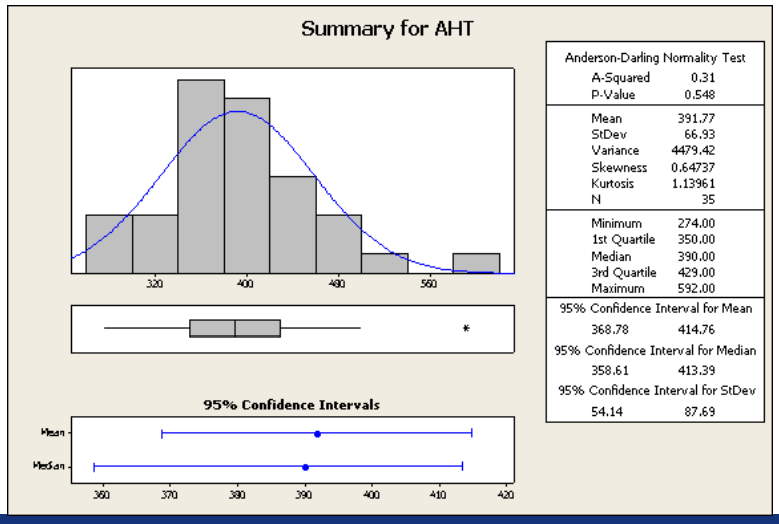


Applying fundamental business statistics concepts to call center metrics

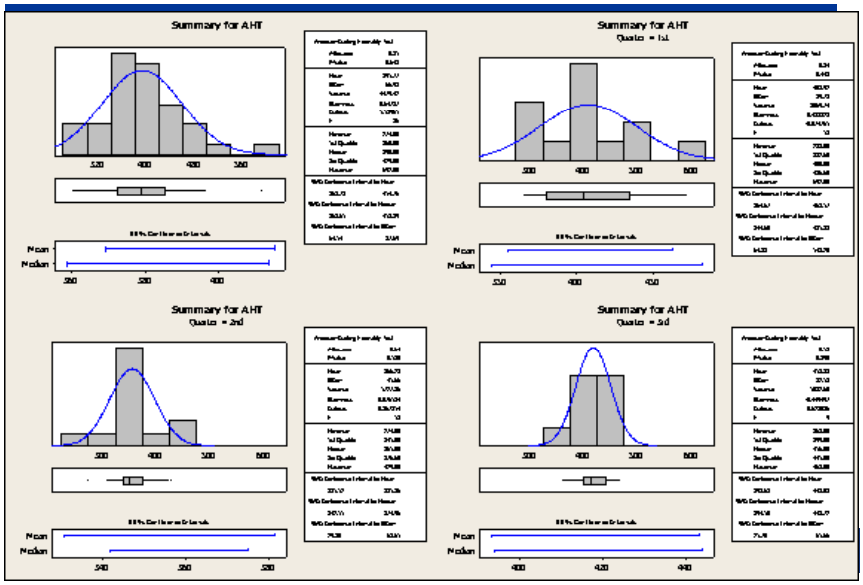
- Given: The following weekly AHT data for a group in seconds.

Quarter	Date	AAHT	Quarter	Date	AAHT	Quarter	Date	AAHT
1st	06-Jan	500	2nd	06-Apr	344	3rd	06-Jul	358
1st	13-Jan	474	2nd	13-Apr	307	3rd	13-Jul	390
1st	20-Jan	300	2nd	20-Apr	274	3rd	20-Jul	408
1st	27-Jan	293	2nd	27-Apr	338	3rd	27-Jul	430
1st	03-Feb	499	2nd	04-May	352	3rd	03-Aug	414
1st	10-Feb	412	2nd	11-May	360	3rd	10-Aug	446
1st	17-Feb	400	2nd	18-May	351	3rd	17-Aug	468
1st	24-Feb	410	2nd	25-May	374	3rd	24-Aug	436
1st	02-Mar	390	2nd	01-Jun	350	3rd	31-Aug	415
1st	09-Mar	288	2nd	08-Jun	429			
1st	16-Mar	592	2nd	15-Jun	349			
1st	23-Mar	393	2nd	22-Jun	377			
1st	30-Mar	365	2nd	29-Jun	426			

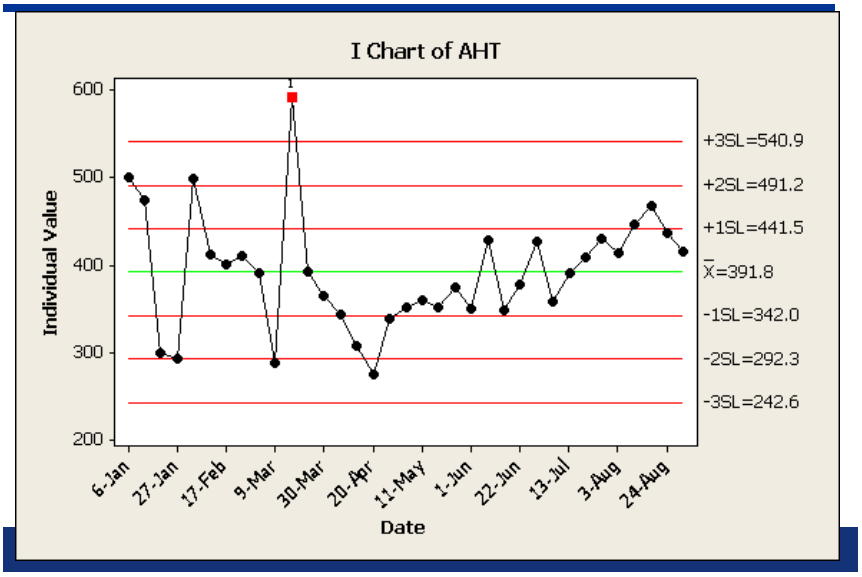
Calculated Statistics



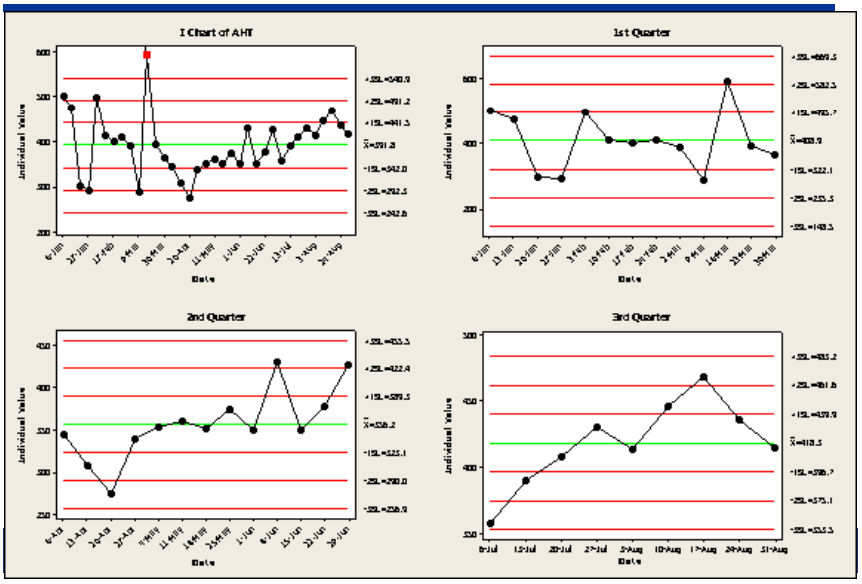
Calculated Statistics by Quarter



Calculated Statistics via Control Charts

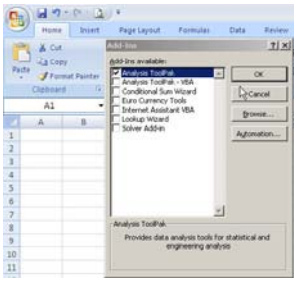


Calculated Statistics via Control Charts



Using Excel to provide statistical data

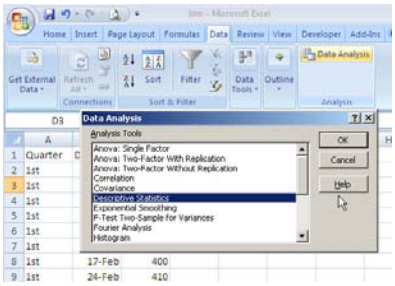
- In Excel go to your options and add the Analysis Toolpack Add-In.

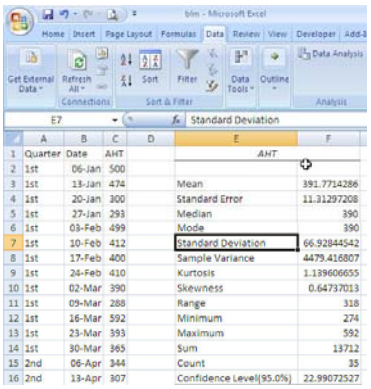


- Go to the Data tab and select Data Analysis

Using Excel to provide statistical data

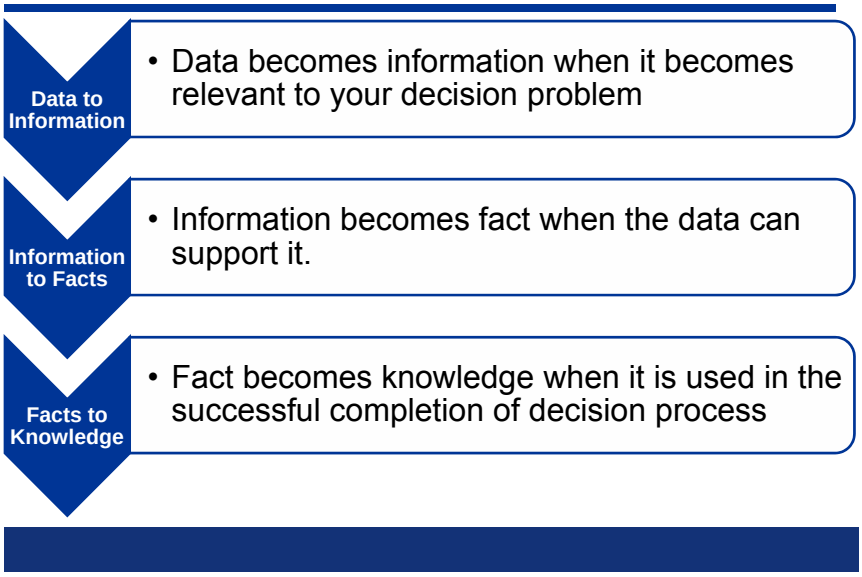
- Select Descriptive Statistics and analyze your data as you feel fit.





	A	B	C	D	E	F
1	Quarter	Date	AHT			
2	1st	06-Jan	500			
3	1st	13-Jan	474		Mean	391.7714286
4	1st	20-Jan	300		Standard Error	11.31297208
5	1st	27-Jan	293		Median	390
6	1st	03-Feb	499		Mode	390
7	1st	10-Feb	412		Standard Deviation	66.92844542
8	1st	17-Feb	400		Sample Variance	4479.416807
9	1st	24-Feb	410		Kurtosis	1.139606655
10	1st	02-Mar	390		Skewness	0.64737013
11	1st	09-Mar	288		Range	318
12	1st	16-Mar	592		Minimum	274
13	1st	23-Mar	393		Maximum	592
14	1st	30-Mar	365		Sum	13712
15	2nd	06-Apr	344		Count	35
16	2nd	13-Apr	307		Confidence Level(95.0%)	22.99072527

Sequence from Data to Knowledge



Conclusion