

# The Life Cycle of a Trend

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**FLUOR**<sup>®</sup>

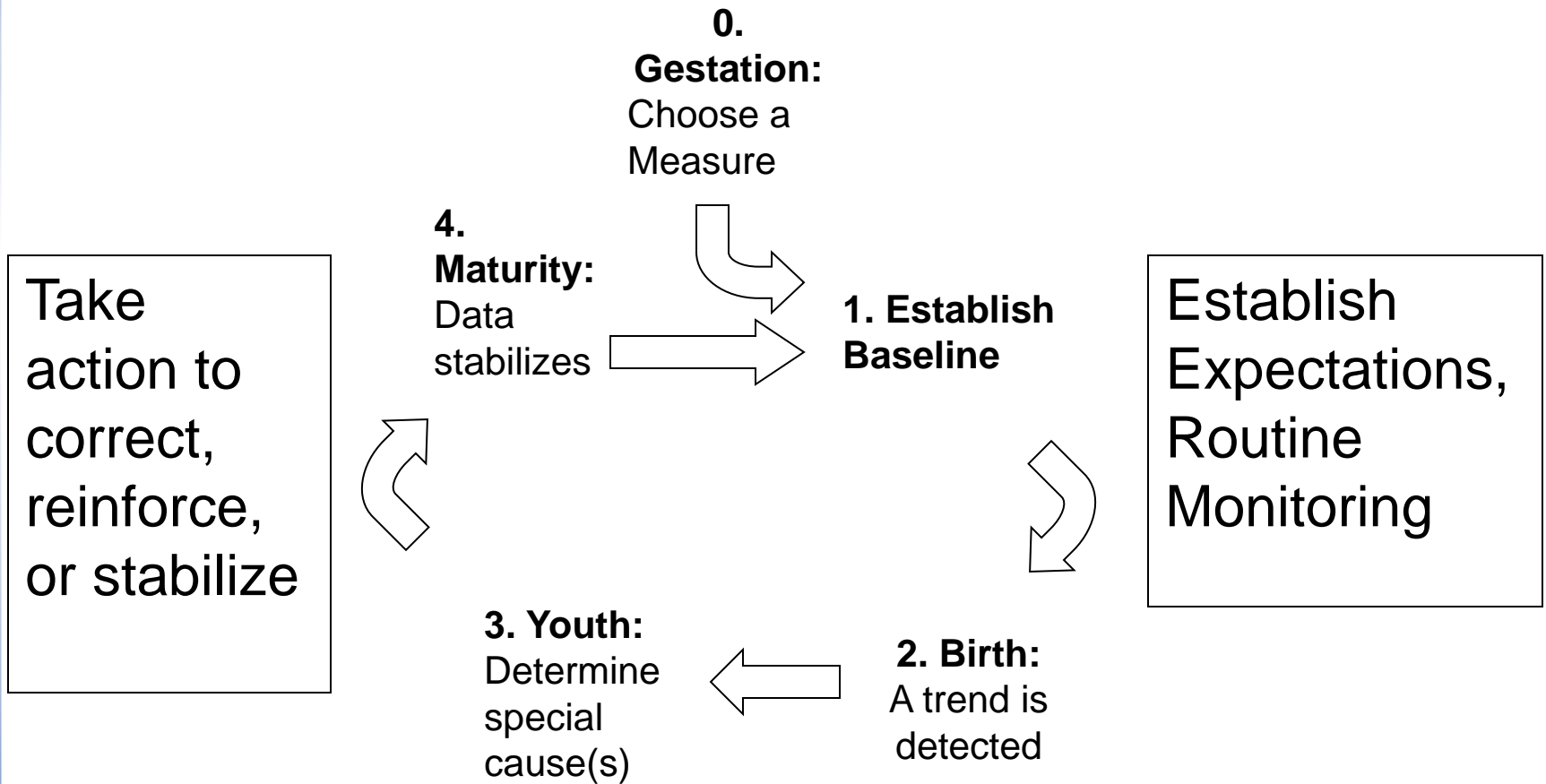
# Introduction

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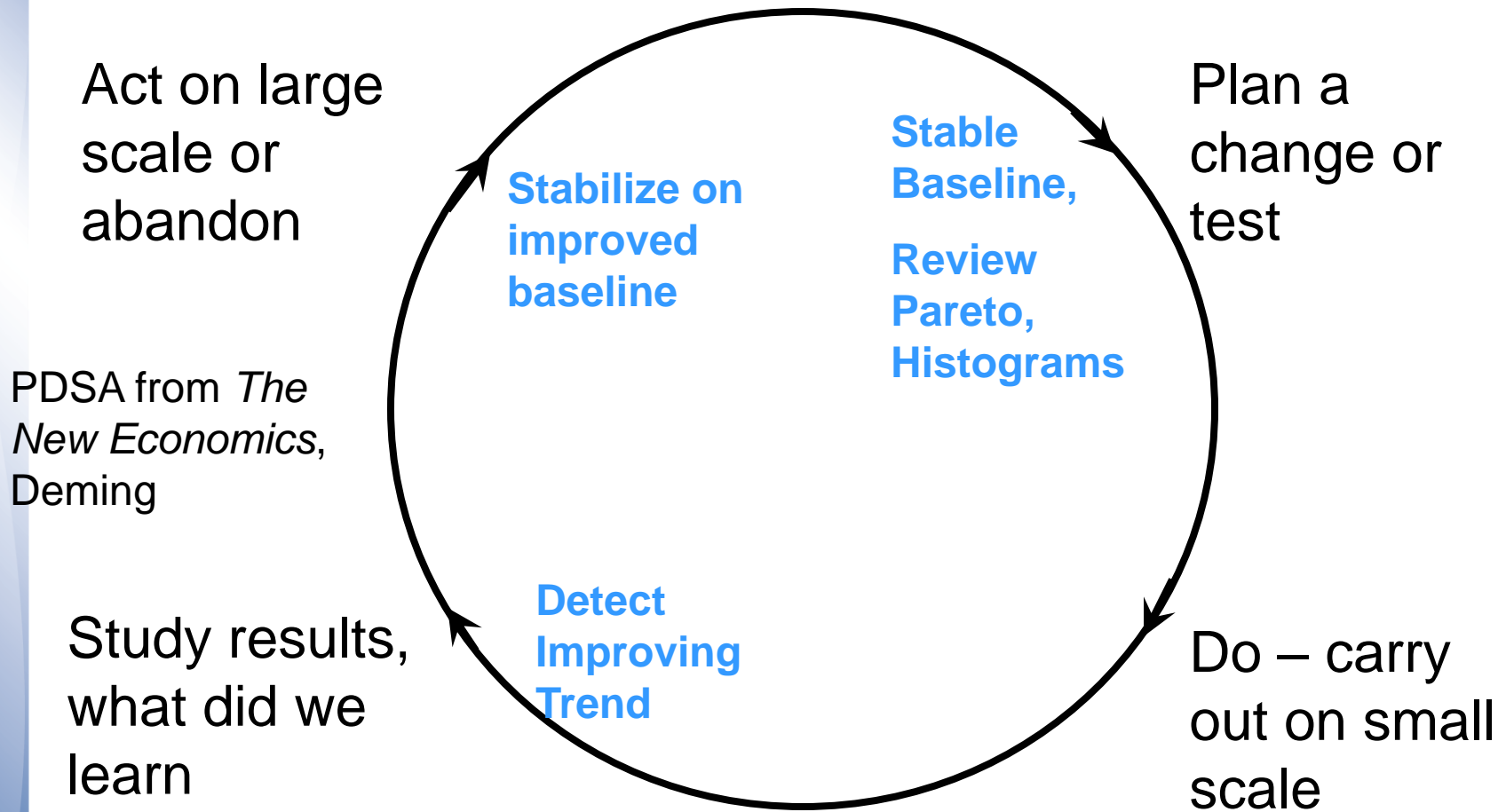
**This presentation provides detailed information on**

- **Establishing baselines**
- **Detecting a Trend**
- **What to do following a Trend**
- **How to rebaseline**
- **Trending in the context of a Management System**

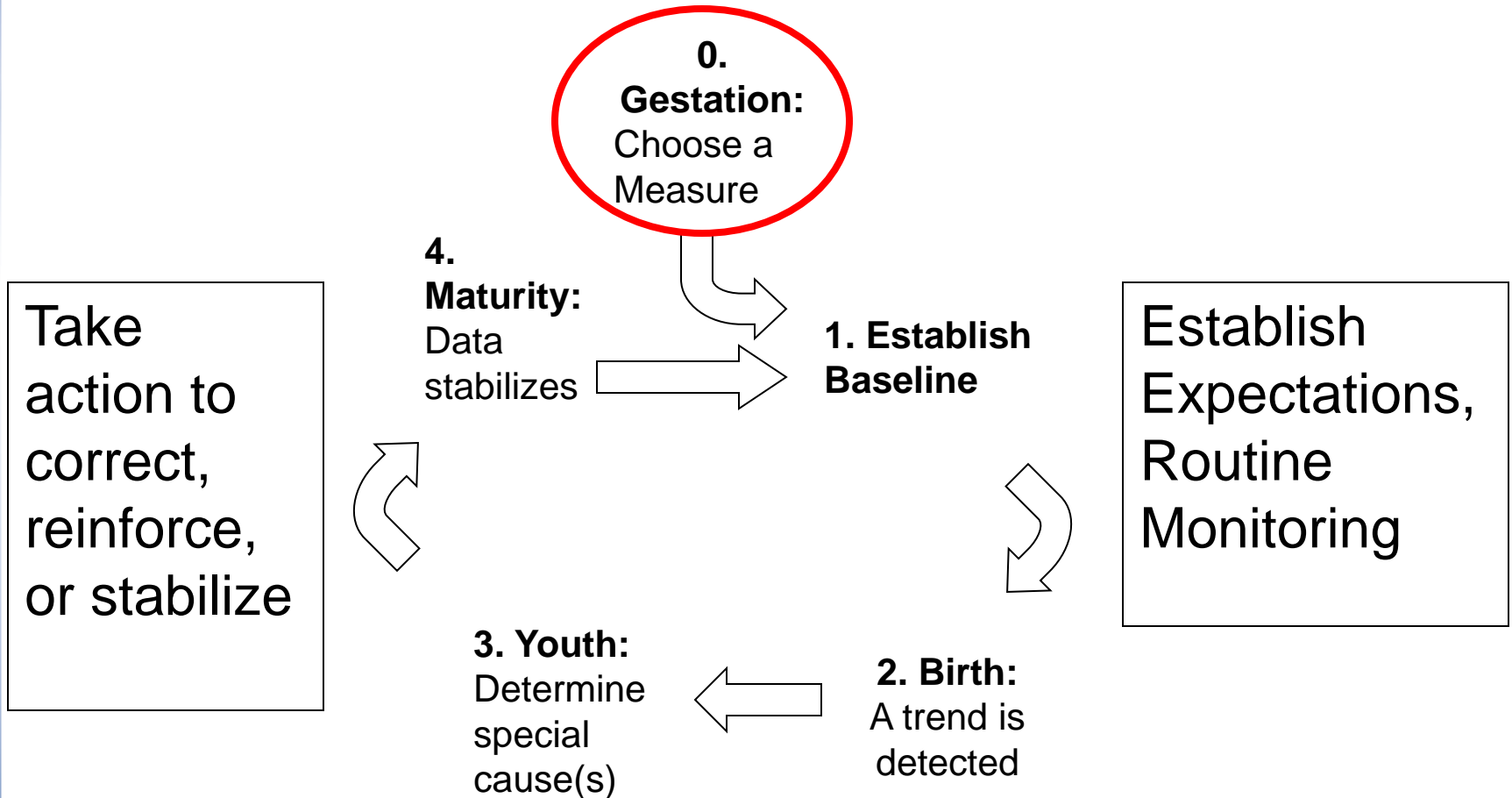
# Trending Cycle



# Similarity with PDSA (Shewhart) Cycle



# Trending Cycle



# 0. Gestation – Management and Analyst Role

- **Decide what to measure**

[http://www.efcog.org/wg/esh\\_es/Statistical\\_Process\\_Control/docs/Implementing\\_Performance\\_Measures.pdf](http://www.efcog.org/wg/esh_es/Statistical_Process_Control/docs/Implementing_Performance_Measures.pdf)

- **Develop Operational Definition**
- **Independent data, and do not cumulate**
- **Determine data source(s)**
- **Gather initial data, hopefully at least 25 data points of history**

# Gathering Data

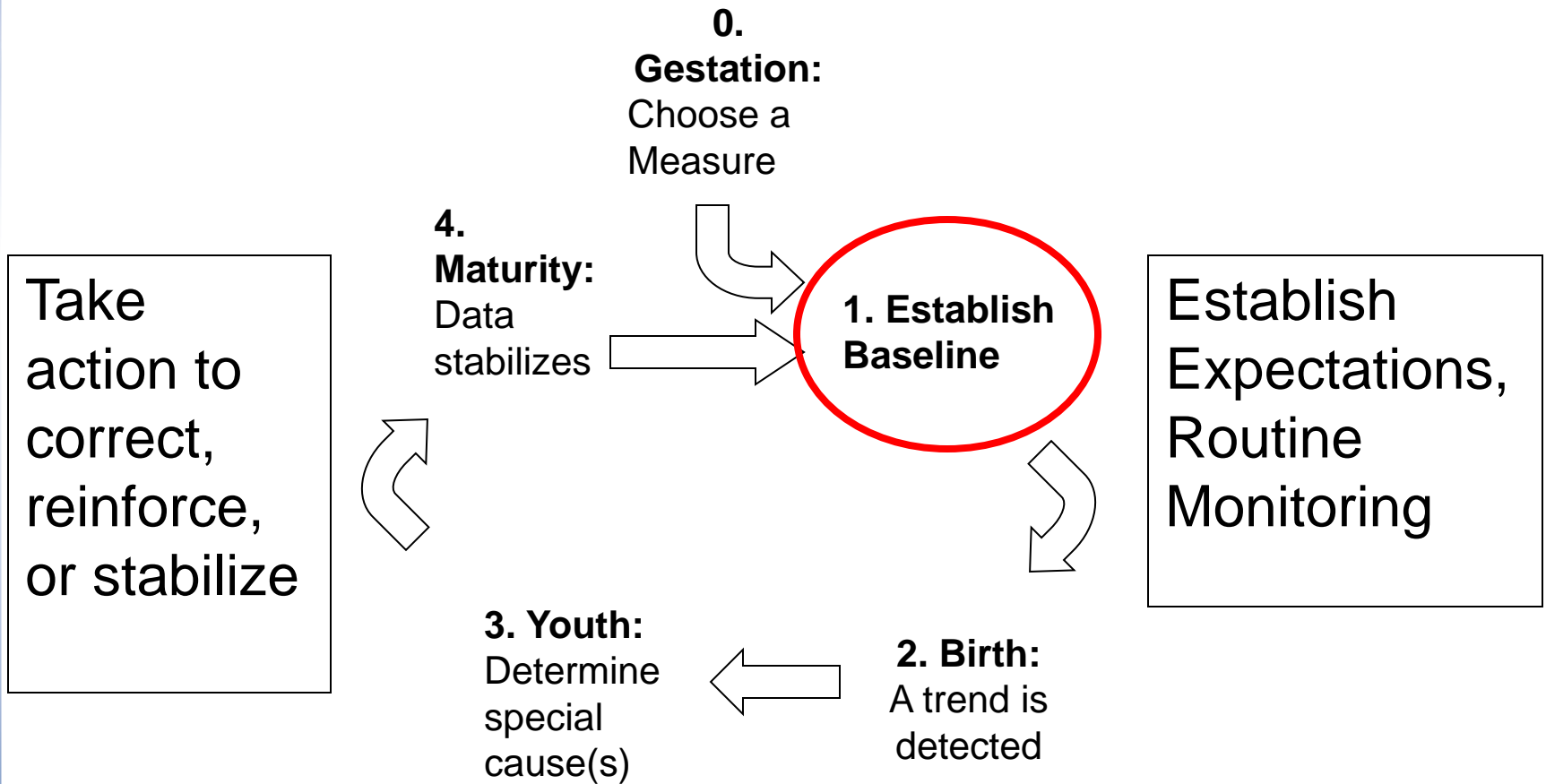
- **Check existing reporting systems.**
- **Many organizations are awash in data, but the data have never been analyzed or put to use.**
- **There is an advantage to using existing data, as it has already been paid for, and historic data for establishing the baseline should be available.**

# Choosing Reporting Intervals

- **If a trend developed, how long could you go without needing to know it? Longer intervals imply more risk**
- **Need sufficient volume of points (25)**
- **Costs increase as reporting interval decreases**
- **What is current reporting interval?**



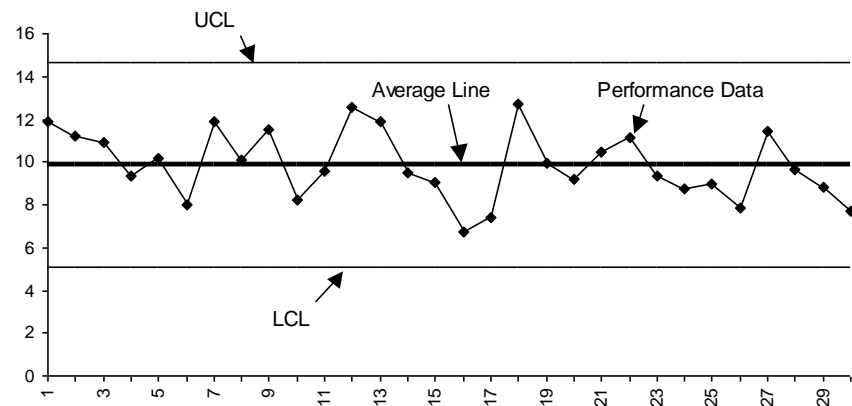
# Trending Cycle



# The Baseline

- The Baseline on a control chart consists of the average (center) line, a 3 standard deviation Upper Control Limit (UCL) and a 3 standard deviation Lower Control Limit (LCL).
- The Baseline allows us to predict the future, and evaluate for trends.
- A procedure for choosing the proper form of control chart, and calculating the baseline and control limits is available at [http://www.efcog.org/wg/esh\\_es/Statistical Process Control/docs/Generating and Using Control Charts.pdf](http://www.efcog.org/wg/esh_es/Statistical%20Process%20Control/docs/Generating%20and%20Using%20Control%20Charts.pdf)

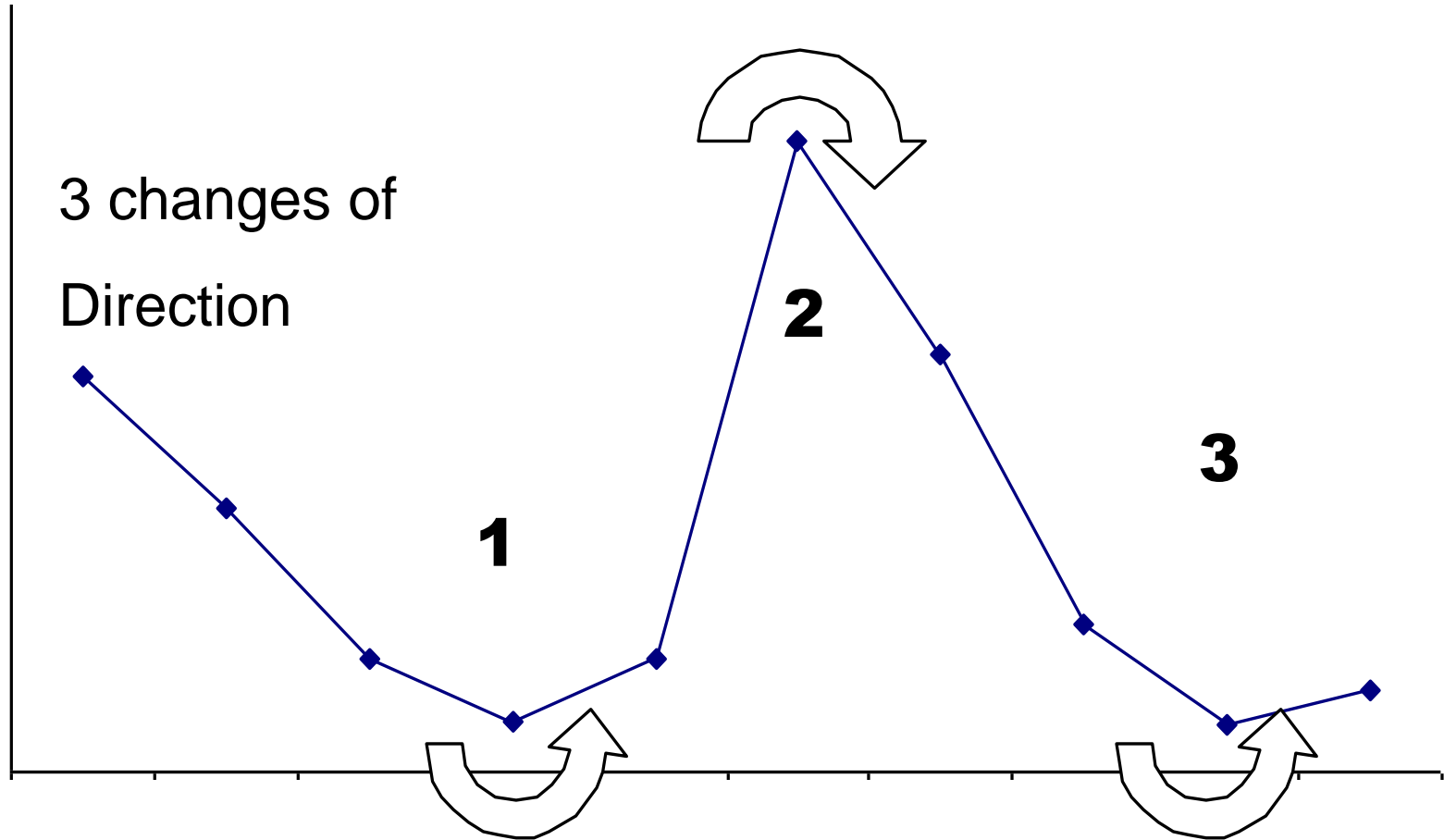
- SRNS: Q1-1 105
- EFCOG Trending Primer
- INPO 07-007



# 1. Establishing the Baseline – Analyst Role

- The goal is to establish one or more baseline time intervals with no trends within each interval.
- The “MW Rule” helps to show if a baseline is likely to be “good”.
- A “good” baseline detects future trends with a minimum of false alarms.
- If a trend is detected, we don’t want it to be due to too few data points in the baseline, causing the baseline to have been inaccurate.

# “MW” Rule



# Initial Strategy

- **Use the first 25 points for a trial baseline**
- **If less than 25, use all points, assuming MW rule is met**
- **Evaluate for trends within this trial baseline**
  
- **NOTE: Do not change a baseline unless it is “proven guilty” by a Trend**

# This is a Trend!

- **One point outside the control limits**
- **Two out of Three points two standard deviations above/below average**
- **Four out of Five points one standard deviation above/below average**
- **Seven points in a row all above/below average**
- **Ten out of Eleven points in a row all above/below average**
- **Seven points in a row all increasing/decreasing.**

# Remove Trends from the Trial Baseline

**Do show all data, but change the average and control limit calculations by:**

- **Dropping data off of the beginning**
- **Dropping data off of the end**
- **Dropping individual datum point(s) and circling them**
- **Split into two or more baselines**

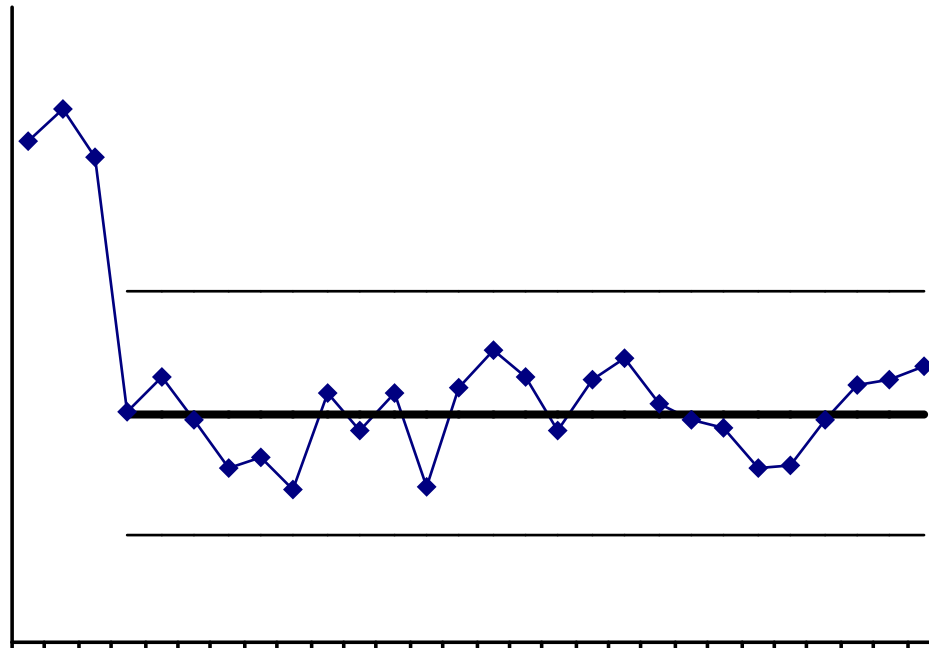
# Initial Baseline

- **In all cases, trends should be investigated to determine the special cause(s)**
- **A circle or a shift in the baseline is a trend**
- **Generally, short term shifts are left circled, long term shifts have a new baseline**
- **Remember – the goal is Prediction of Future Performance**



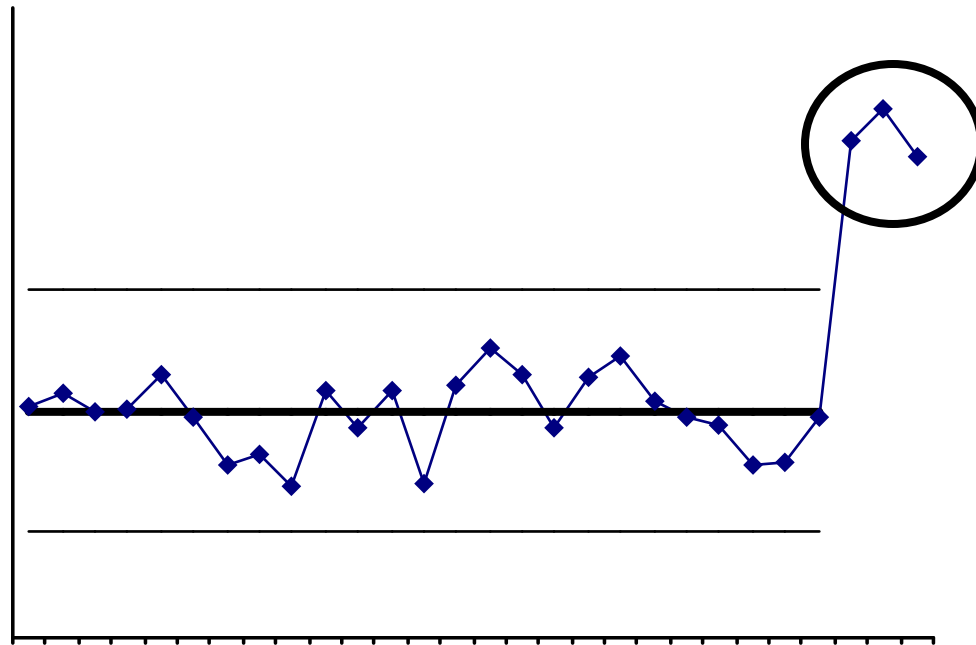
# Example

Three data points removed from the beginning of the data set, leaving a stable baseline from the fourth point onwards:



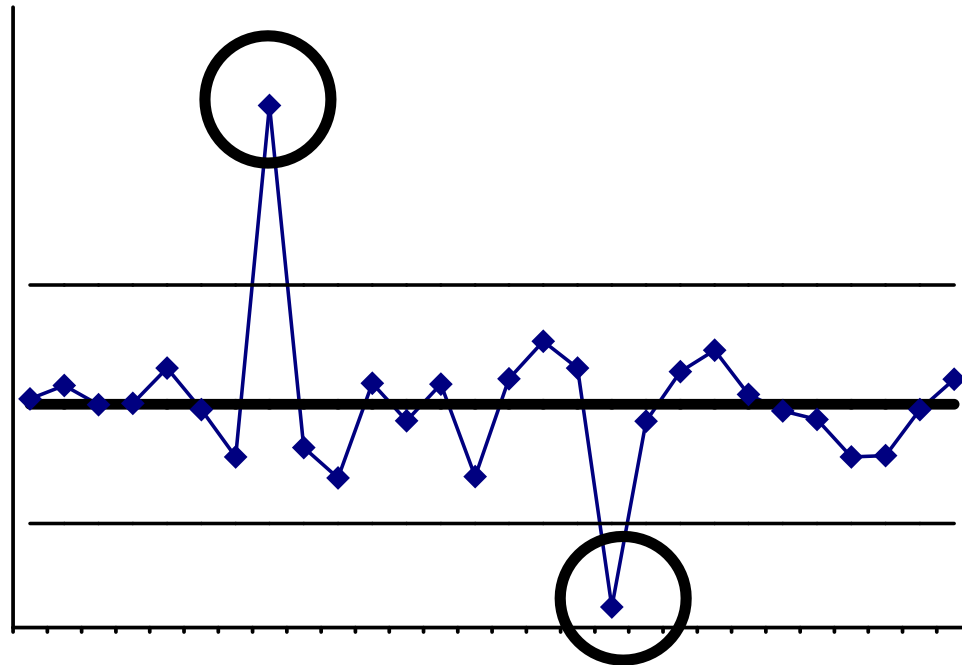
# Example

Three data points removed from the end of the data.



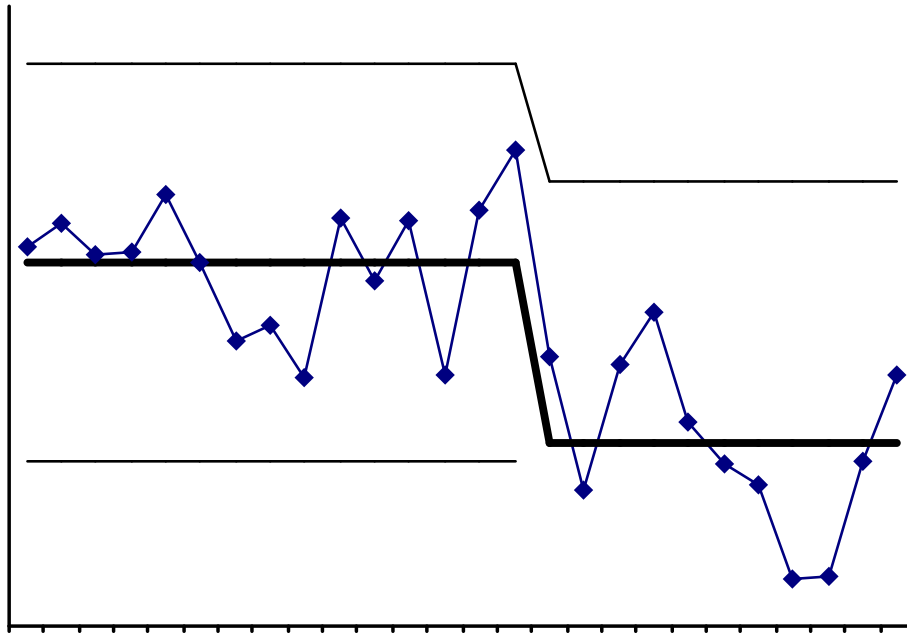
# Example

Two data points within the data have been removed, and the remaining data used to construct the baseline.



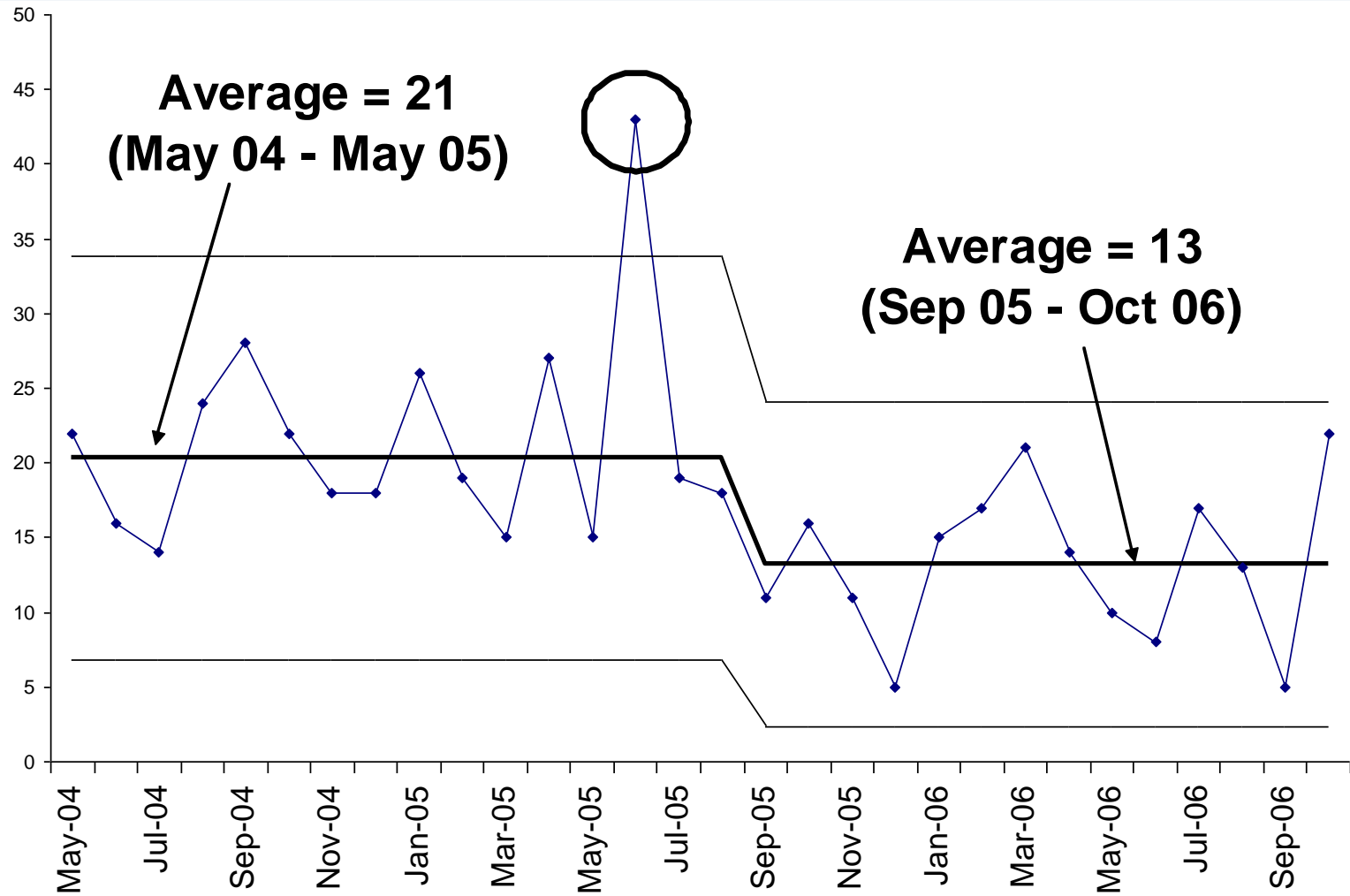
# Example

The data have been split into two baselines.  
A permanent decrease in the level appears to have occurred.



Both  
baselines  
satisfy the  
MW Rule

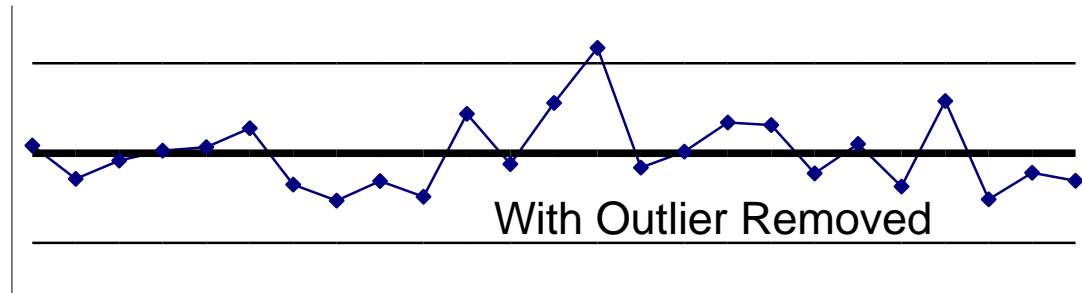
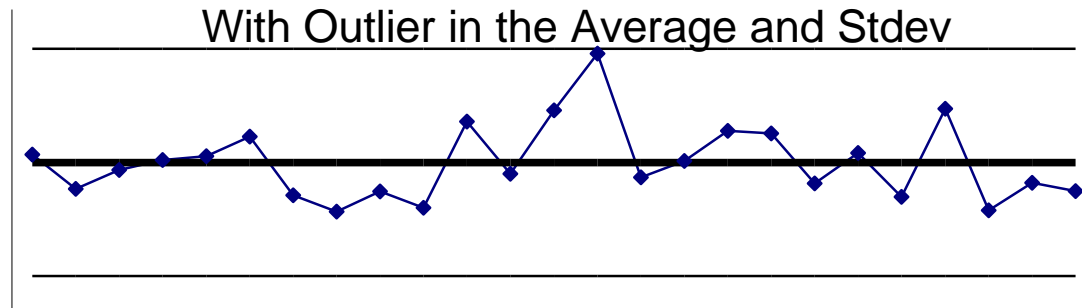
# Real Example



# Standard Deviation

- **Traditionally, the average range has been used to calculate standard deviation**
- **I have found that the statistical standard deviation works well and is easier to calculate in Excel**
- **Watch out for outliers inflating the standard deviation, however**

# Outlier Example (1 point of 25)



# Low Rate Trending

If zeroes are causing problems:

- Leave runs of 7 or more zeroes out (they will always be 7 in a row below average)
- Lengthen the data interval (i.e. from monthly to quarterly)
- Try “Low Rate Trending” (from Understanding Variation, the Key to Managing Chaos, Dr. Donald Wheeler)

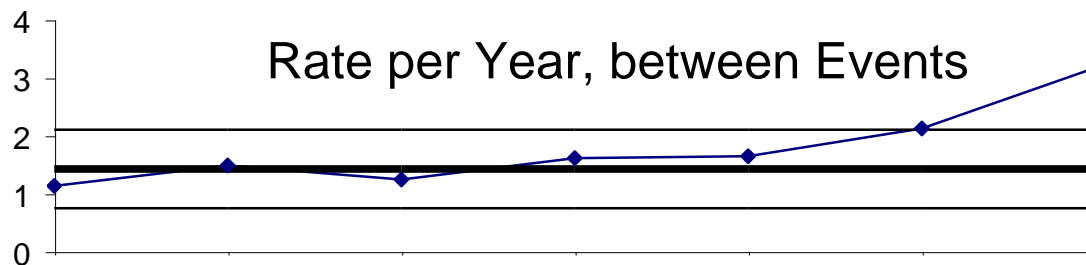
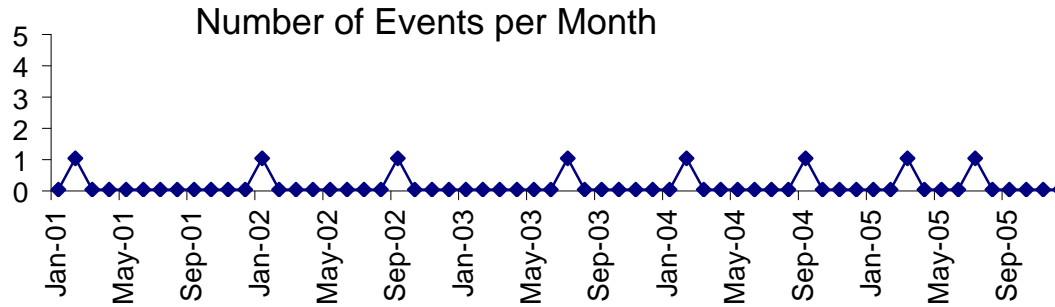
[http://www.efcog.org/wg/esh\\_es/Statistical Process Control/docs/Low Rate Trending.pdf](http://www.efcog.org/wg/esh_es/Statistical%20Process%20Control/docs/Low%20Rate%20Trending.pdf)



# Low Rate Trending Description

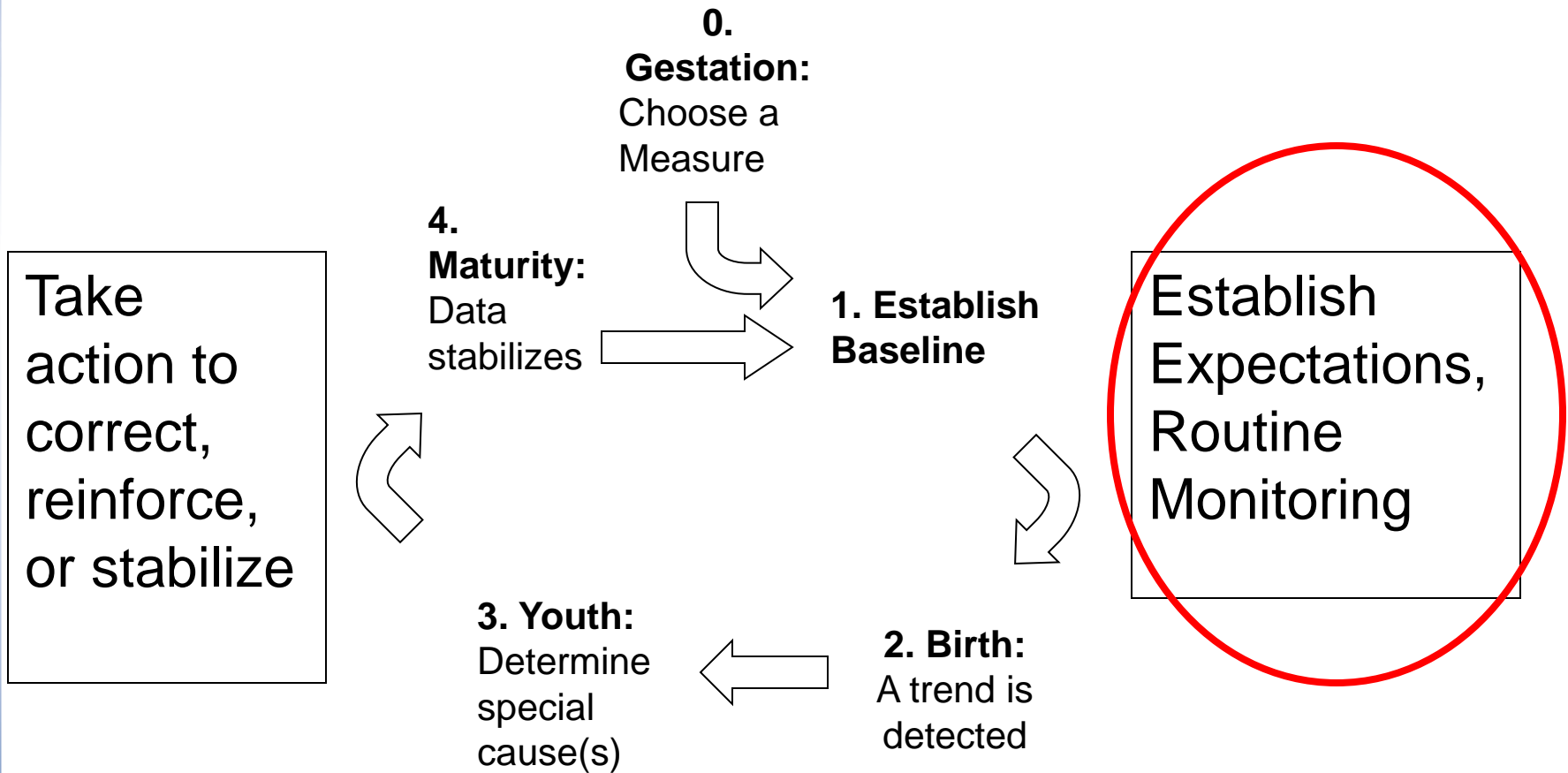
- **Order the data by date of occurrence**
- **Determine the number of days between events**
- **Divide the number of days between events into 365**
- **Plot the resulting rate per year in the date sequence on an x-chart control chart**

# Low Rate Example



Ref: Understanding Variation The Key to Managing Chaos, Wheeler

# Trending Cycle



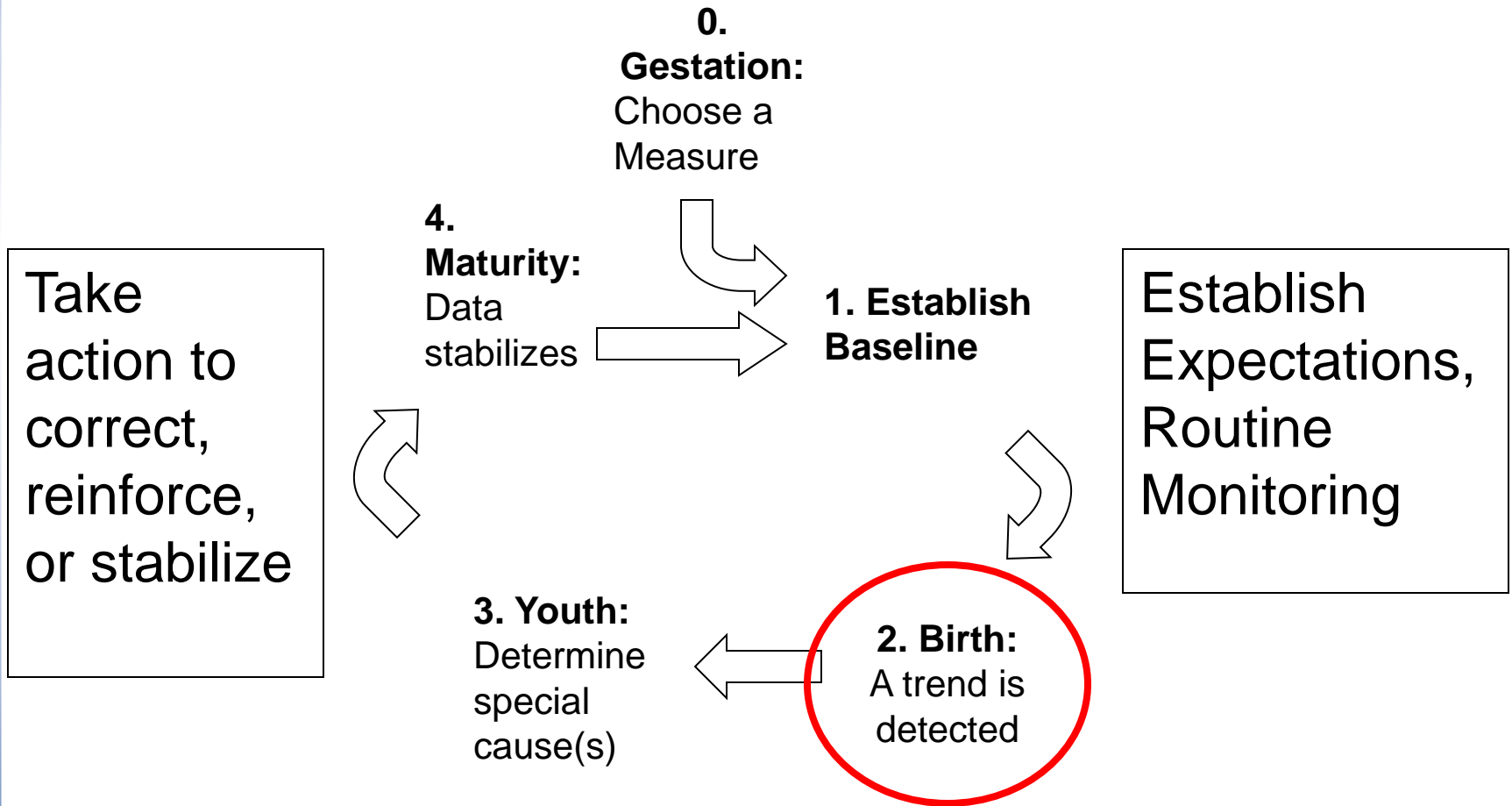
# Establish Expectations – Management Role

- **“Stable” performance is not necessarily good**
- **Management needs to determine if the current stable baseline is “acceptable” or “unacceptable”**
- **May use benchmarks, customer opinion, risk analysis, or management philosophy to make this decision**
- **Management action is needed if it is determined that current stable performance is “unacceptable”.**

# Monitoring

- **Update charts on the required time interval**
- **Check for trends against the trending rules**
- **Circle any trends, inform owning management and look for special cause(s)**
- **Do not shift a baseline unless there is a trend (baseline proven guilty)**

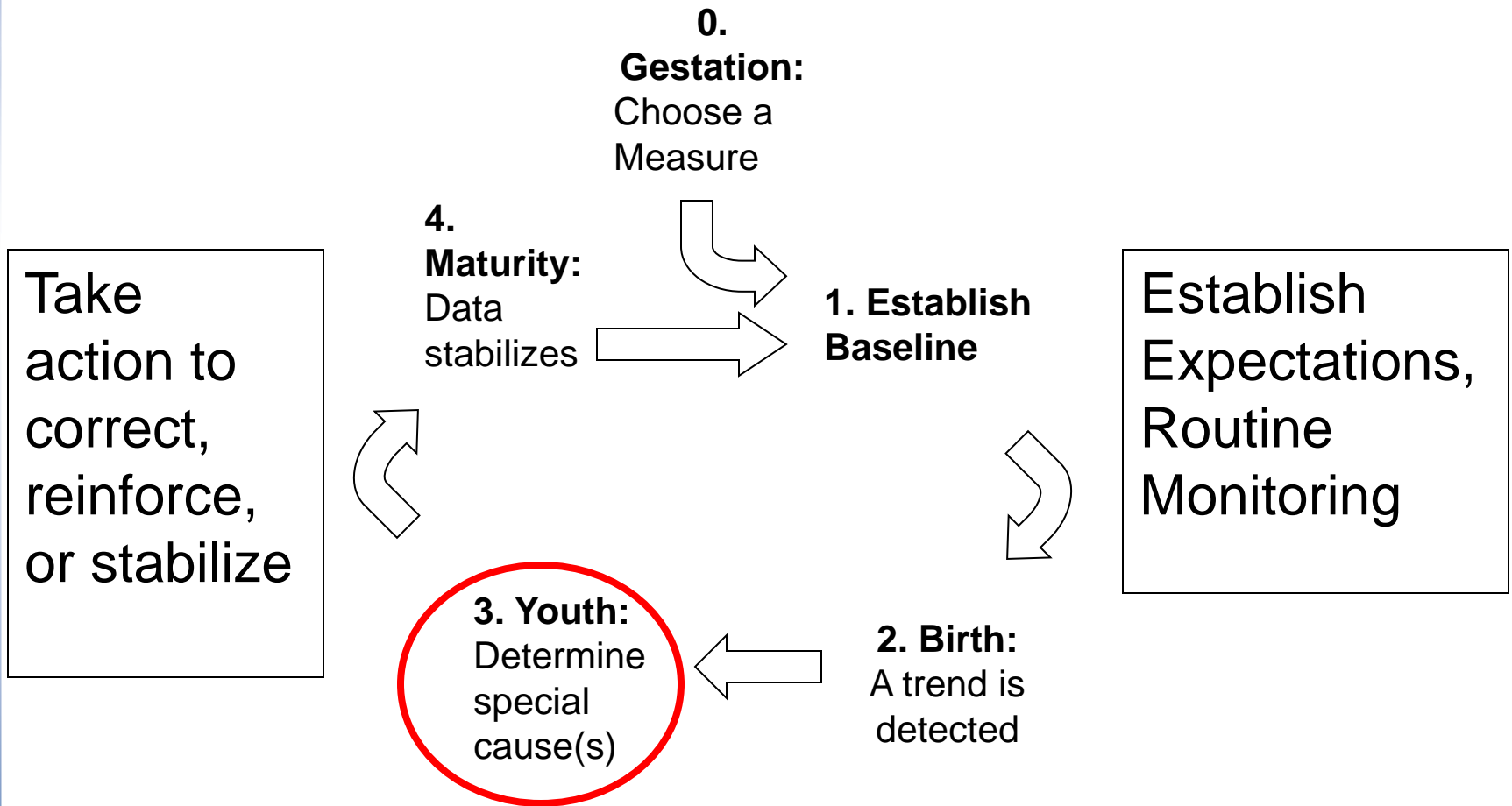
# Trending Cycle



# Detecting a Trend – Analyst Role

- **One point outside the control limits**
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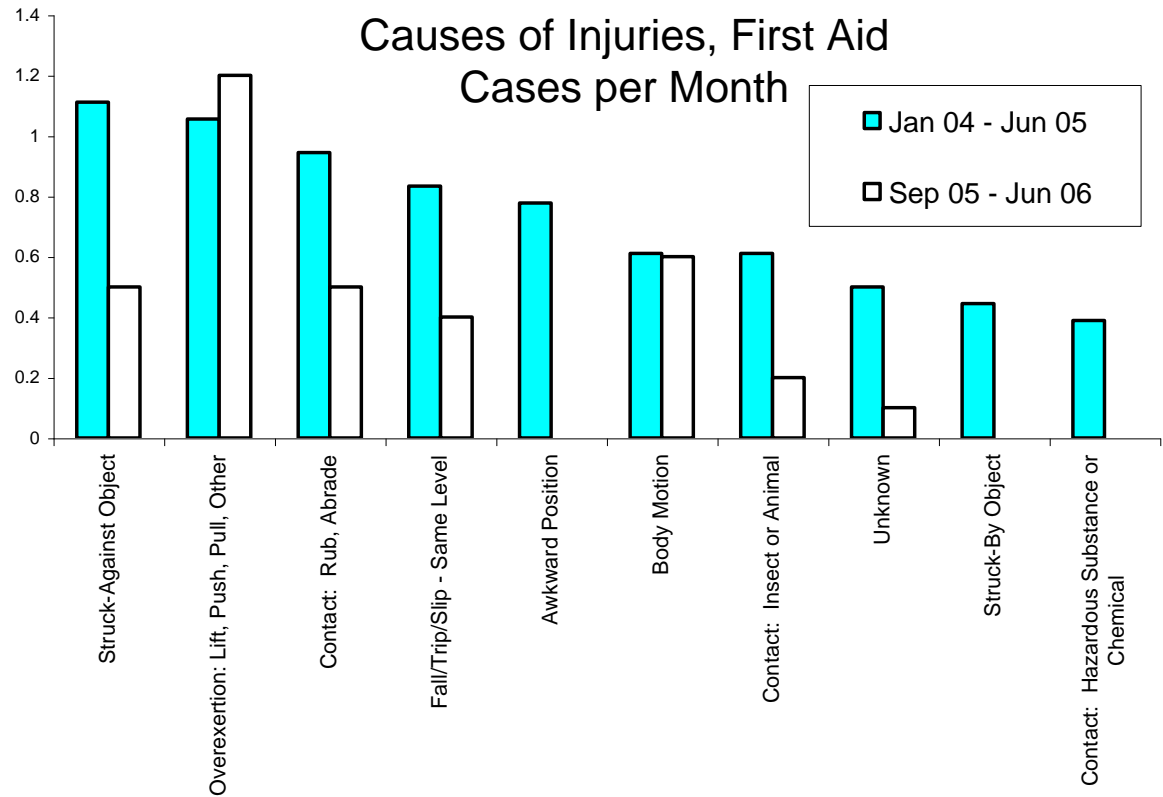
# Trending Cycle



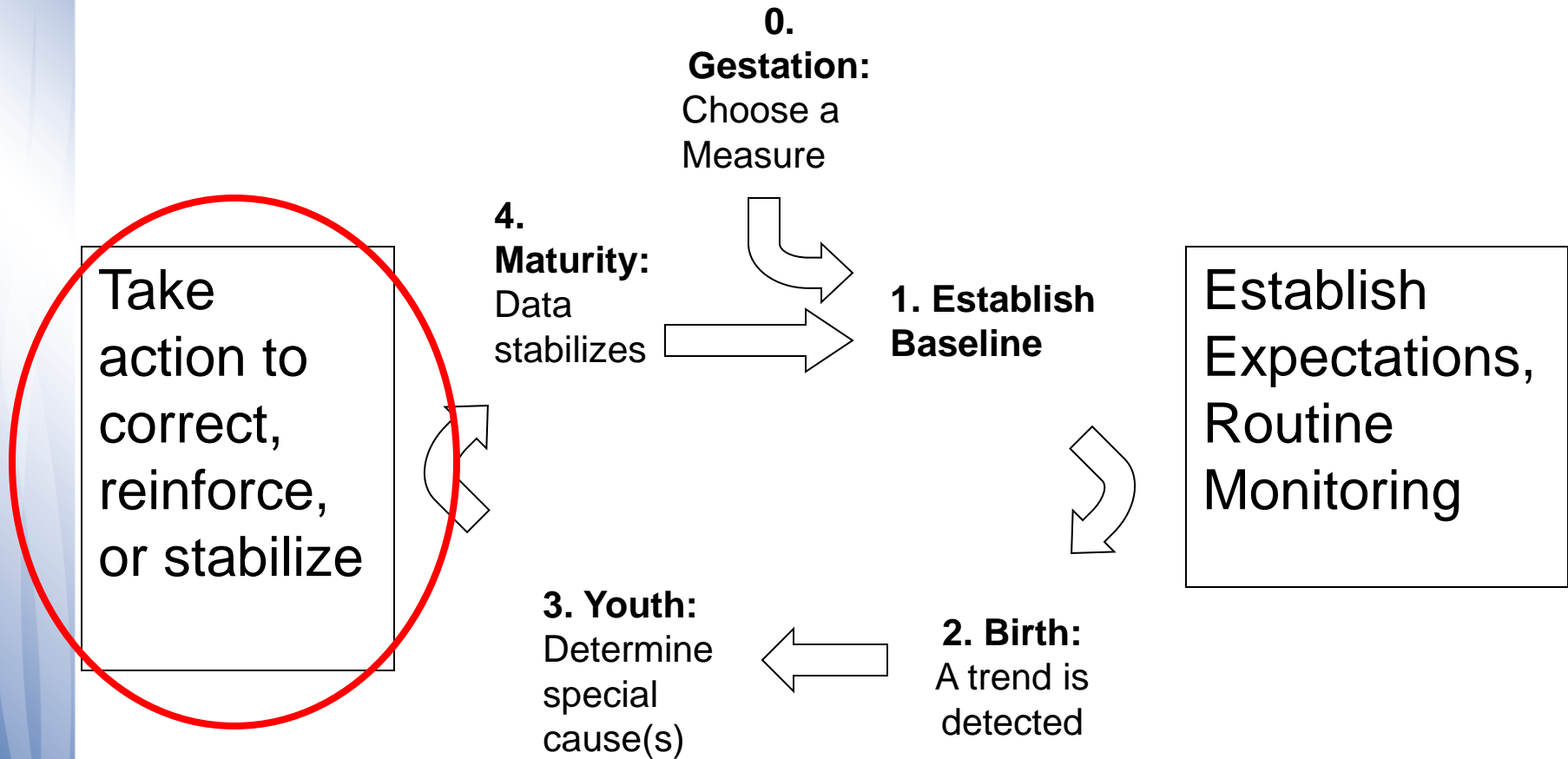


# Determine Special Cause – Analyst Role

- Report the trend to owning management
- Search for Special Causes
- Compare Pareto chart of detailed data during the trend to previous stable time interval



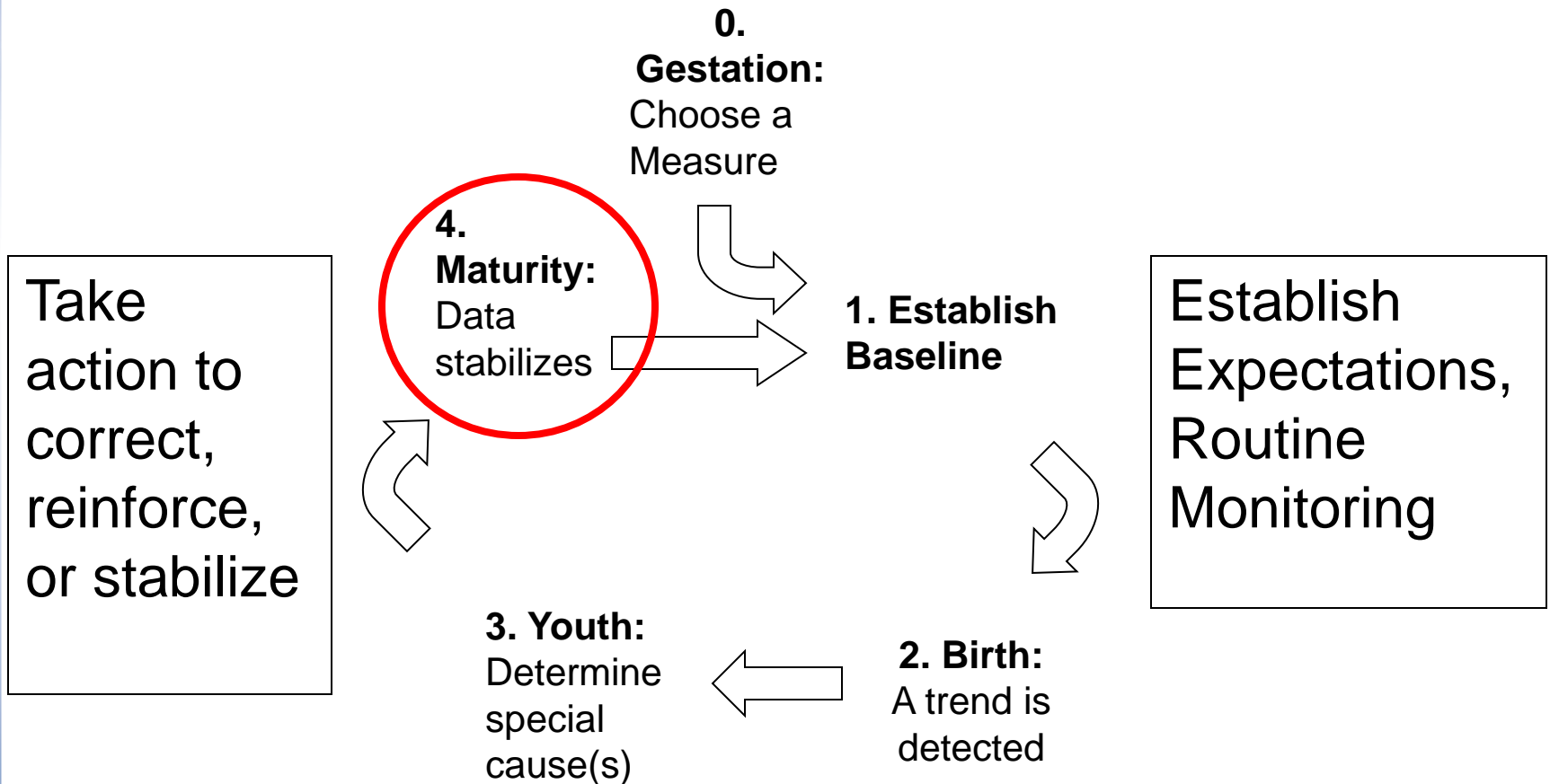
# Trending Cycle



# Take Action – Management Role

- **Management action is needed following a trend**
  - Correct for an adverse trend
  - Reinforce an improving trend
  - If no action is needed, why is indicator being tracked?
- **Corrective Action Management**
- **Lessons Learned**
- **Operating Experience**
- **Celebrations/Recognition**

# Trending Cycle

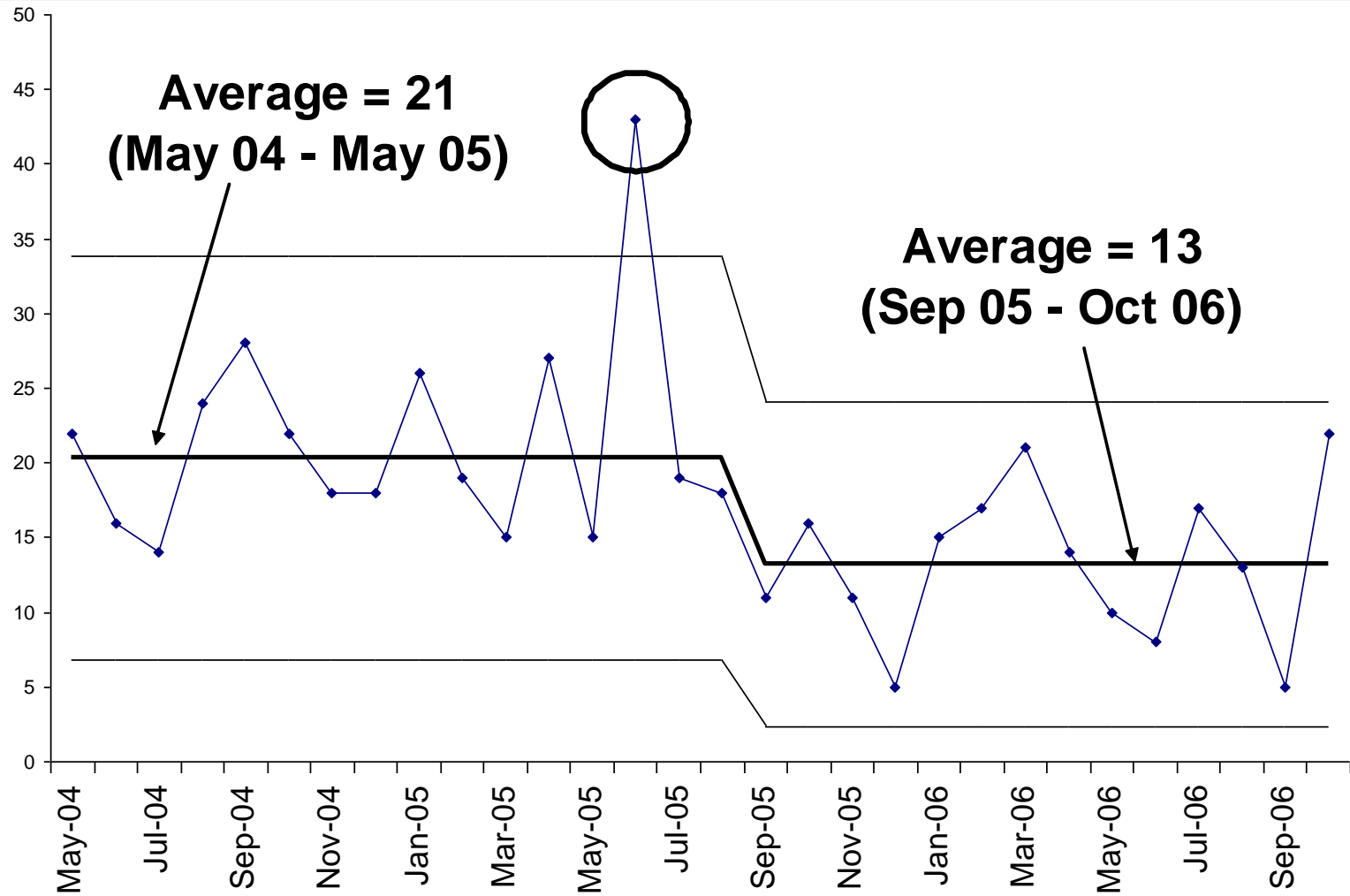


## 4. Data Stabilizes – Analyst Role

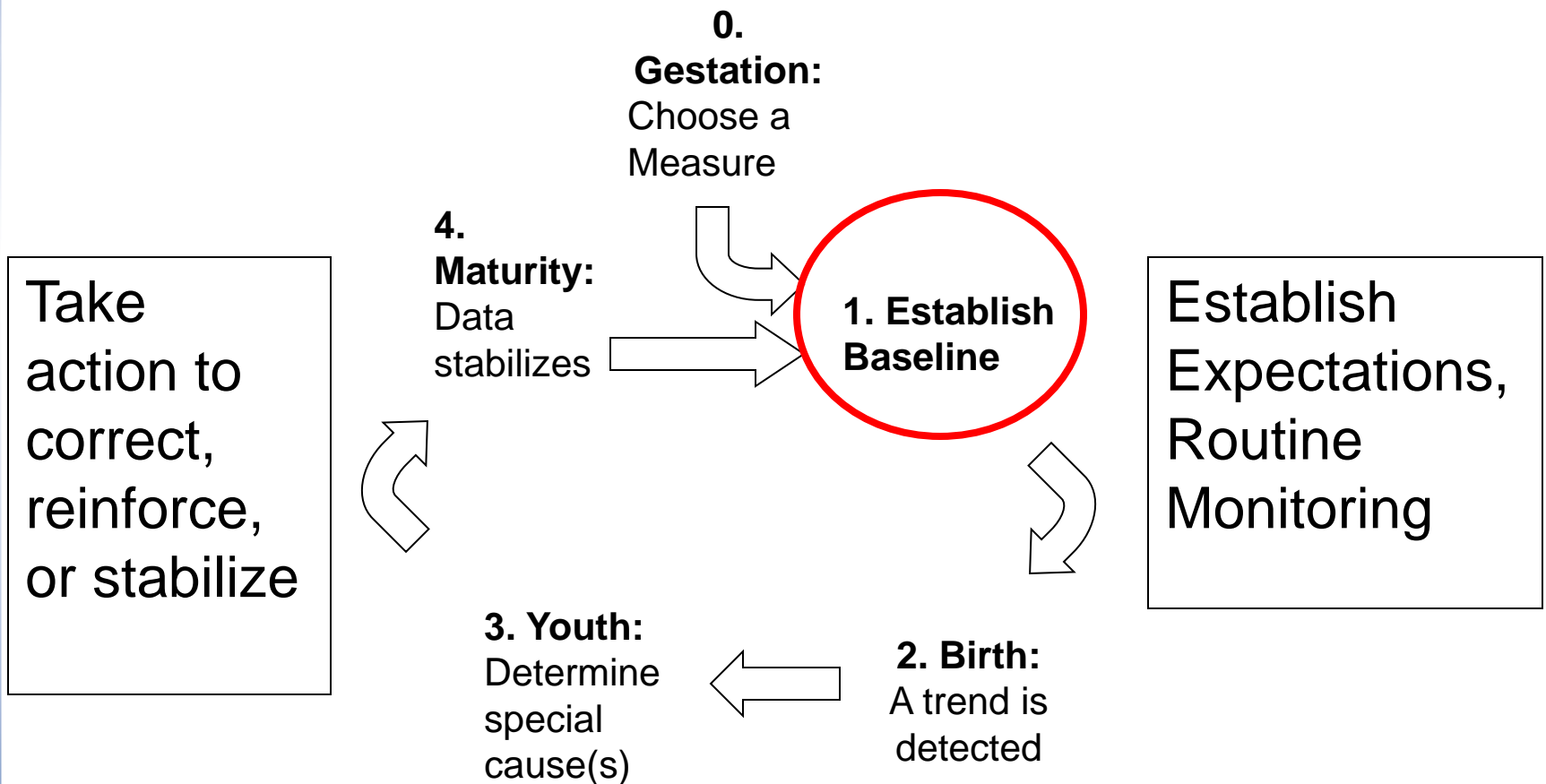
- **Monitor the data in future updates**
- **If new data return to past baseline just leave the trend circled**
- **If data meet the “MW” rule and continue to trigger trend rules, establish a new baseline**

**Note: Even for an adverse trend, if the data stabilize at a new level, we want to establish a new prediction of future performance for management purposes**

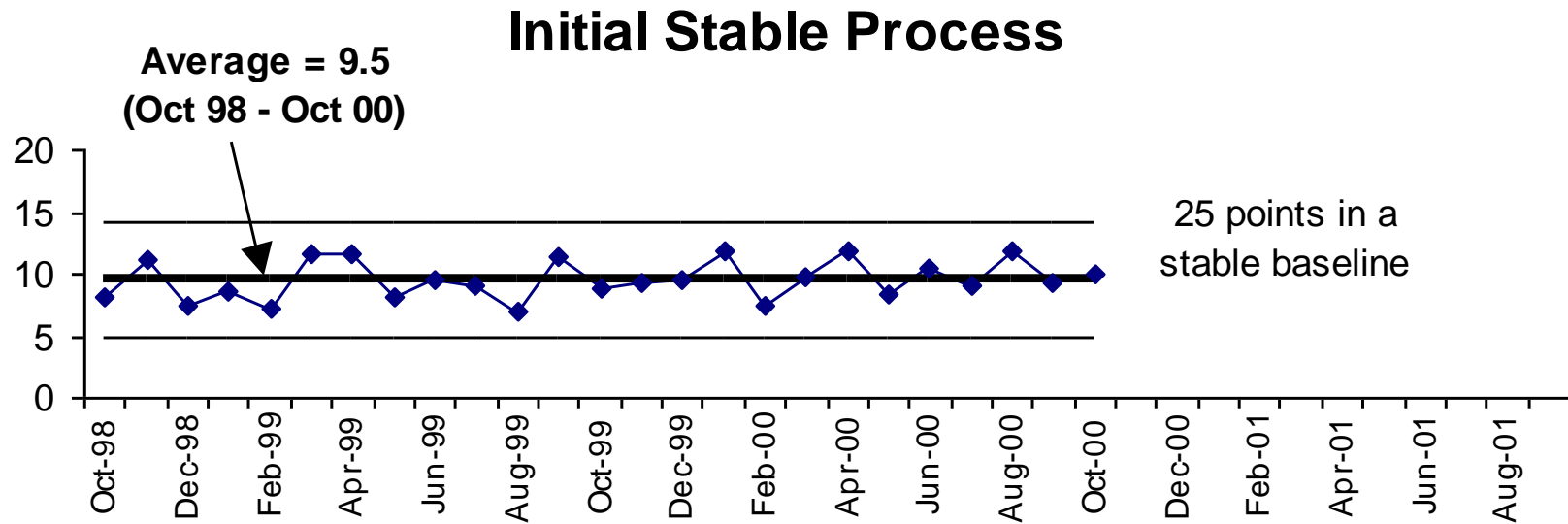
# Example



# A Walk Around the Data Cycle

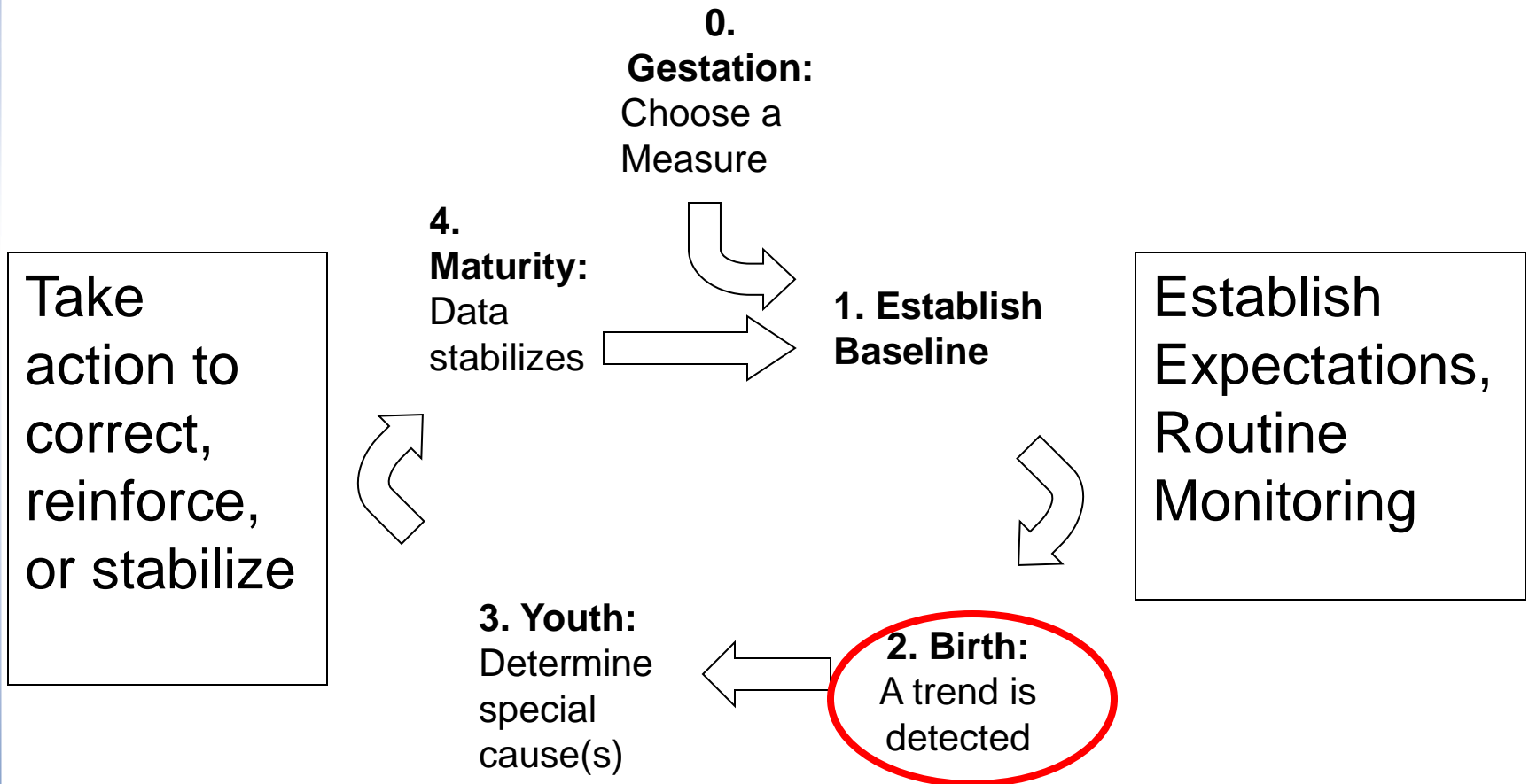


# 1. Establish Baseline

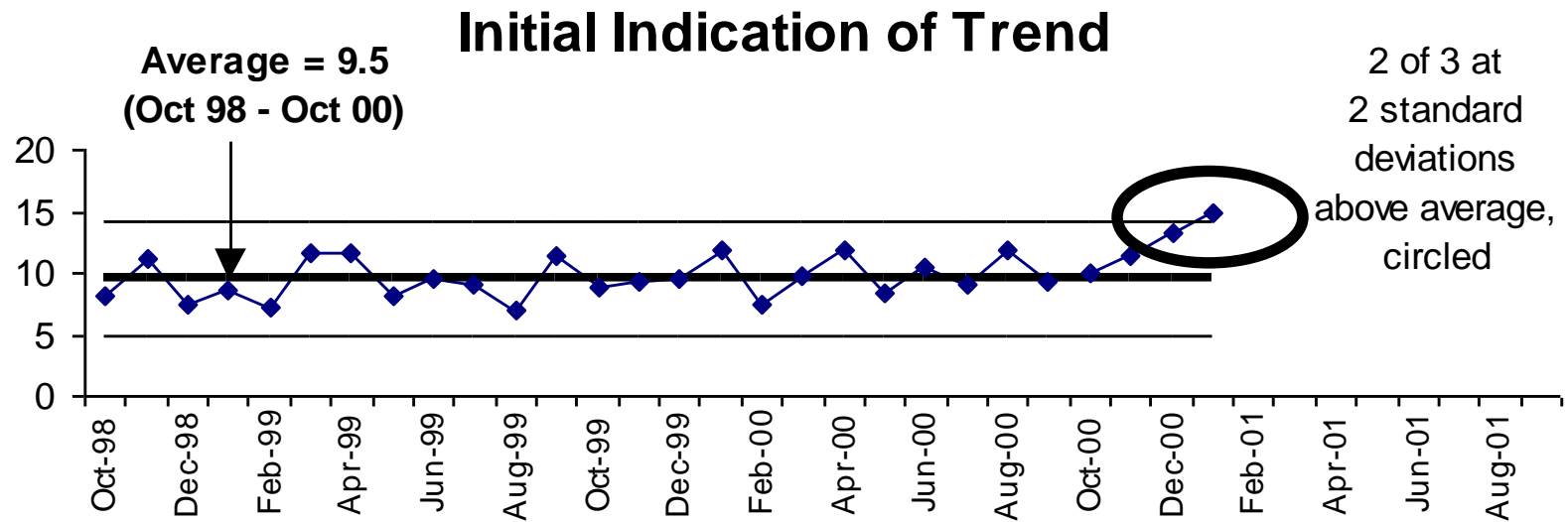




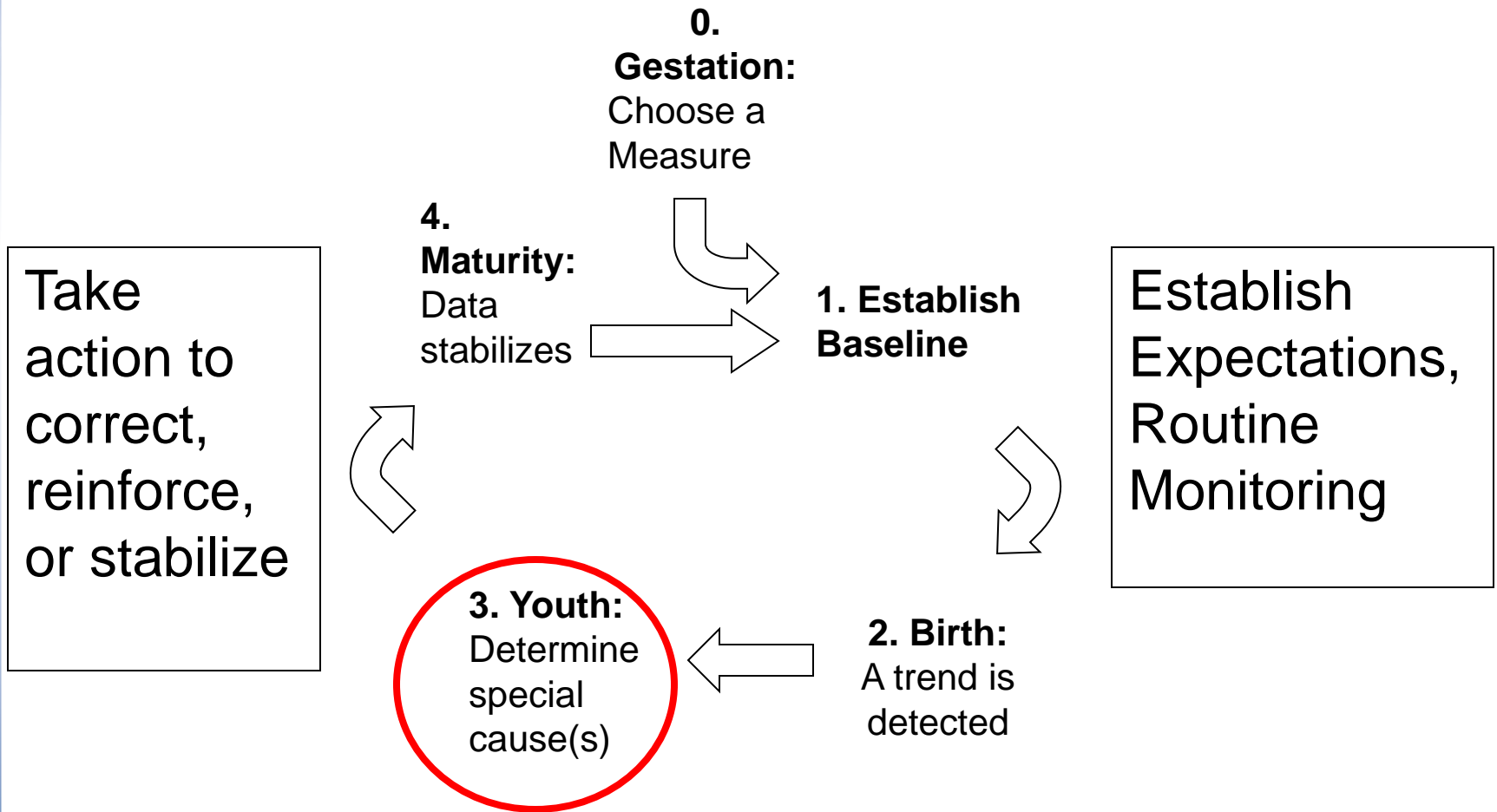
# A Walk Around the Data Cycle



## 2. Birth of the Trend



# A Walk Around the Data Cycle

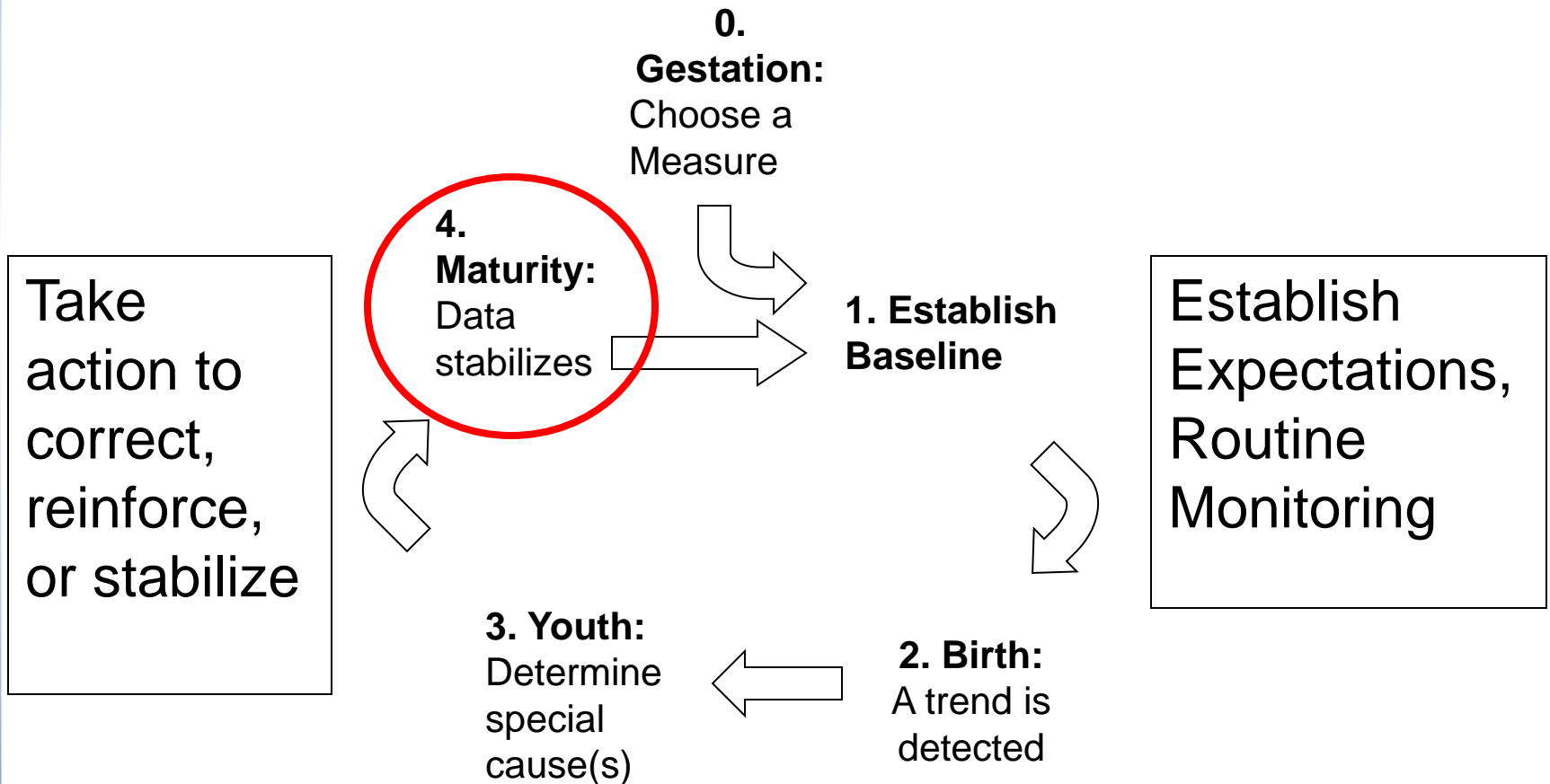


### 3. Youth – Determine Special Causes

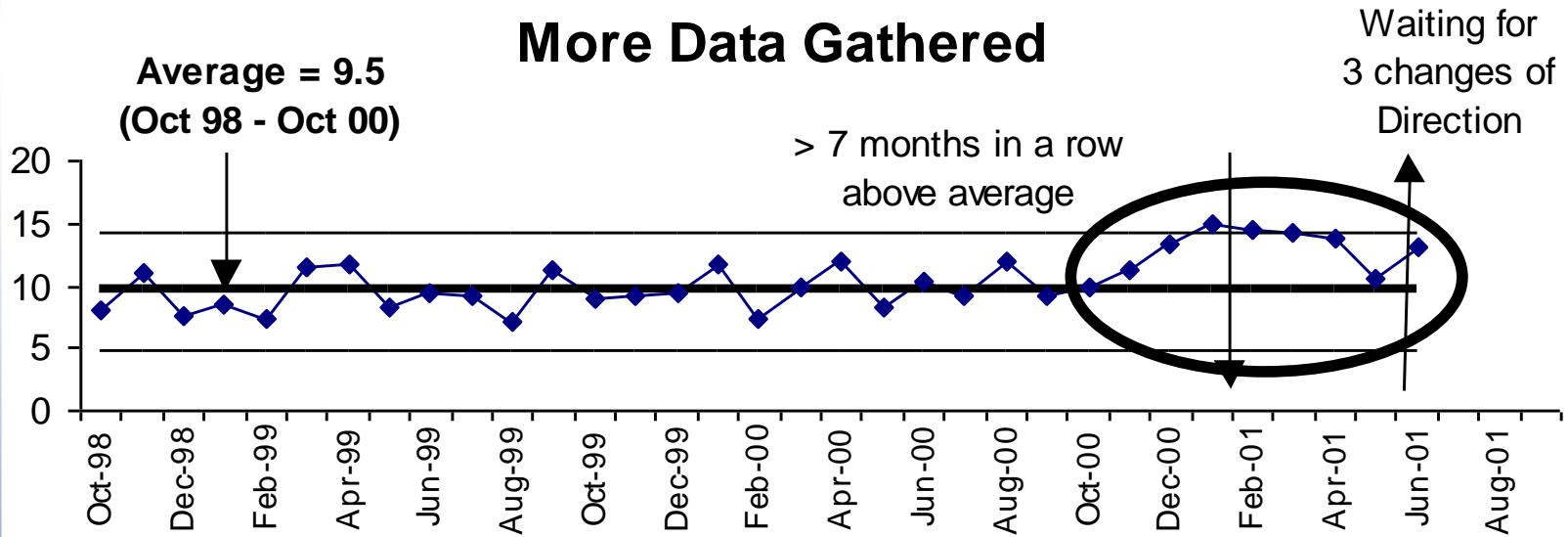
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- **Report the trend**
- **Search for Special Causes**
- **Compare Pareto chart of detailed data during the trend to previous stable time interval**
- **Consider Corrective Action Management necessary steps**

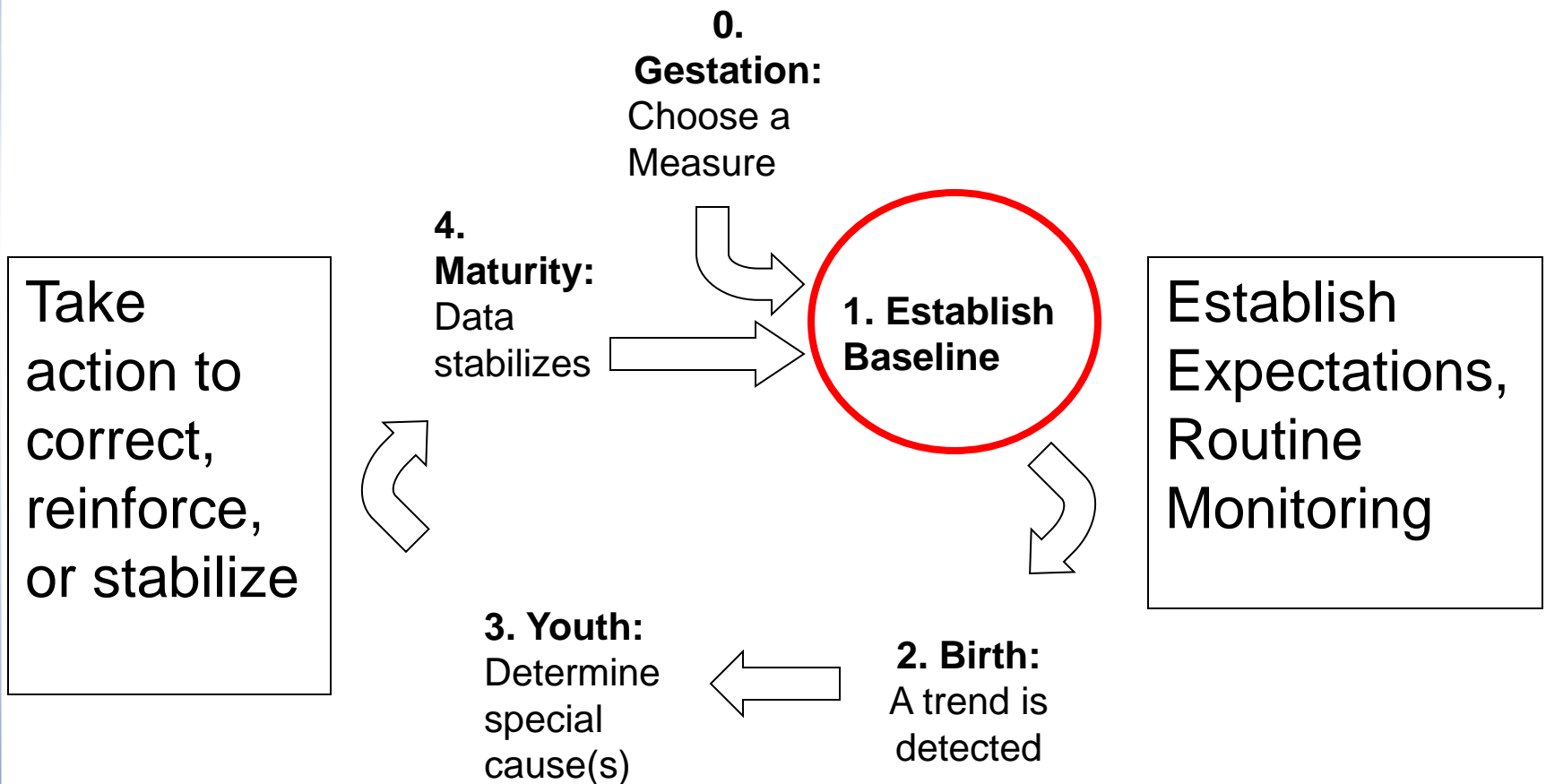
# A Walk Around the Data Cycle



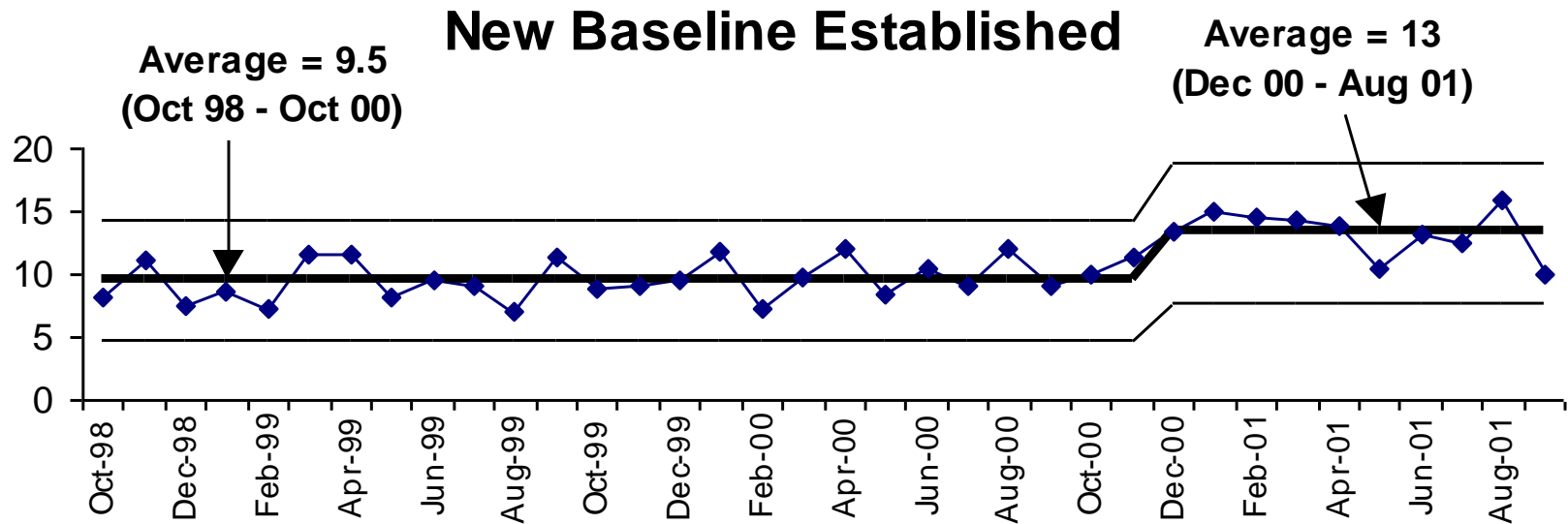
# 4. Maturity – Data Stabilizes



# A Walk Around the Data Cycle



# 1. New Cycle - New Baseline Established





# Conclusion

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- **We can continue to practice with real data and charts**
- **These strategies fit well with the Control Chart Dashboard process**
- **Proper trending and actions taken will lead to significantly improved performance**