HEALTH QUALITY & SAFETY COMMISSION NEW ZEALAND

New adventures in statistical process control

Richard Hamblin

Director of Health Quality Intelligence

Where I started with Statistical Process Control

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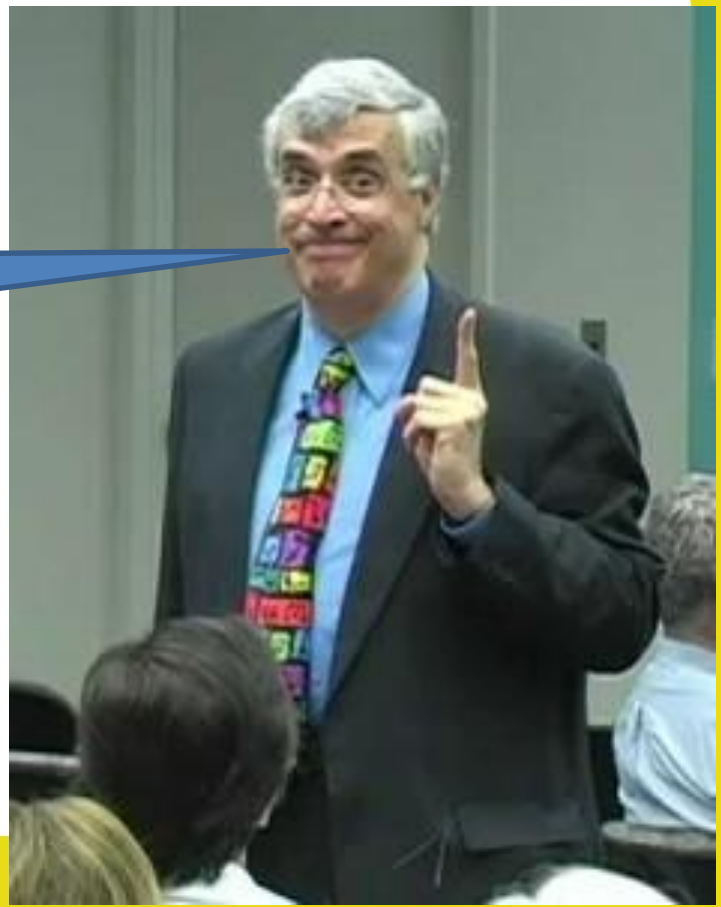
Bear in mind…

ONLY 1 to 2 %
OF PEOPLE NEED
ADVANCED STATISTICS!!



…but you are (probably) the one to two percent

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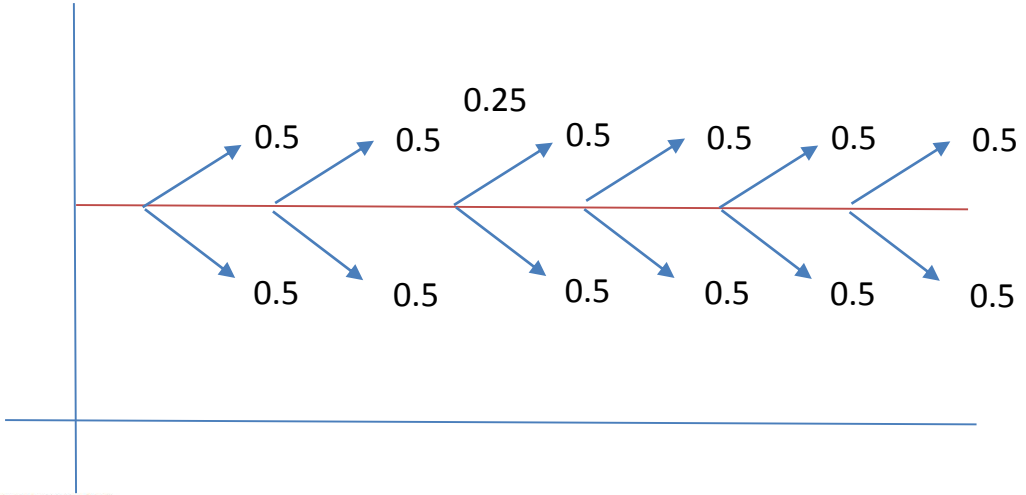
Agenda

- Why SPC is “proper” stats?
- Which chart to use when
- Cusum – spotting small changes quickly

Why SPC is “proper stats”?



$0.5^6 = 0.015625$

$2x0.5^6 = 0.03125$

<0.05

…the maths remains the same…

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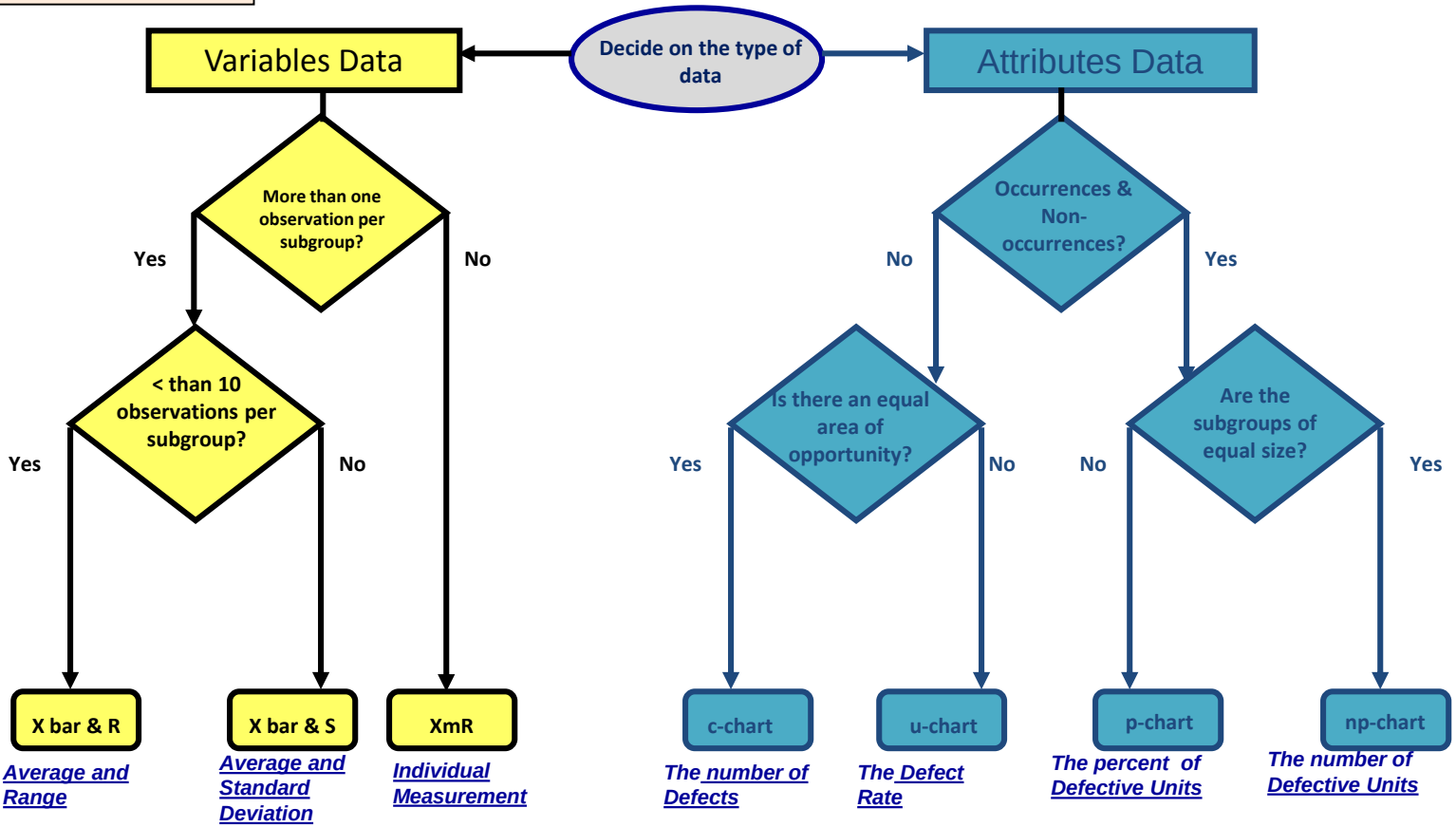
open for better care

Source: Carey, R. and Lloyd, R. *Measuring Quality Improvement in Healthcare: A Guide to Statistical Process Control Applications*. ASQ Press, Milwaukee, WI, 2001.

What control chart when



Cusum – CUMulative SUM of differences

- Useful for small numbers
- Measures cumulative sum of differences over time from reference value
- Intrinsic / Extrinsic reference value
- Intrinsic – long term mean of a time series – essentially means cusum value will end at zero
- Extrinsic can be externally determined acceptable value or derived from a population mean for the same time series – often uses observed versus expected
- Can use logarithmic transformations of data (but we'll not get into that today)

Basic difference

- Intrinsic – has something changed?

- Extrinsic – is something changing?

Intrinsic method

- Suppose we have data on surgical site infection following hip and knee surgery

- Over to excel

V- mask steps

1. Calculate series mean
2. Calculate difference of each data point from series mean
3. Calculate cumulative sum of differences
4. Calculate the Vmask
   - Calculate h (end mask range)
   - Calculate slope $h \pm (khp)$
   - Where p = periods before end point and k = 0.5

Intrinsic reference

- Good “after the fact”
- Useful for small numbers
- Does not allow comparison with absolute performance or other providers
- Not useful for spotting a process going out of control

Extrinsic method

- Imagine we have some data for SAB infections

- Back to excel

Extrinsic – observed versus expected

1. Calculate observed rate
2. Calculate expected rate
3. Calculate observed minus expected
4. Calculate cumulative sum of observed minus expected

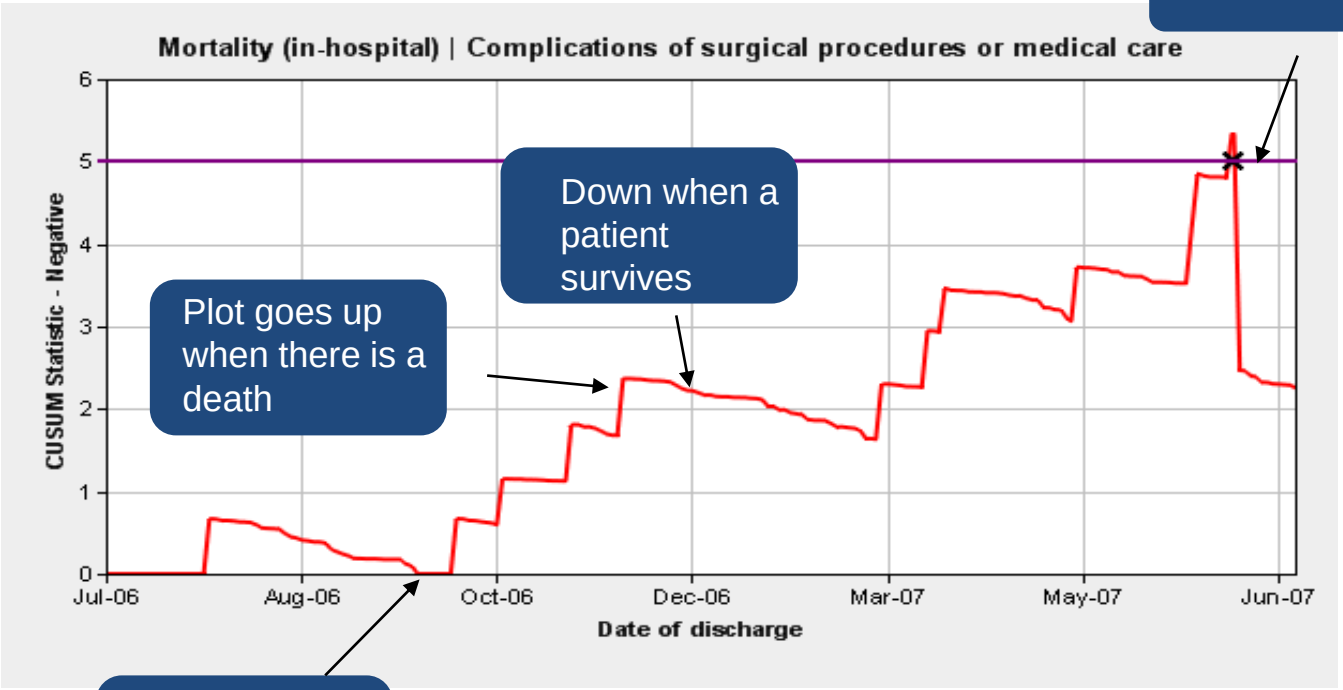
   Max of $Max(0, SH_{i-1} + X_i - target - k)$, $Min(0, SL_{i-1} + X_i - target + k)$

   Where K= 0.5 Sigma, Sigma = Mean R/1.128
5. Add predefined alert level (4 or 5)

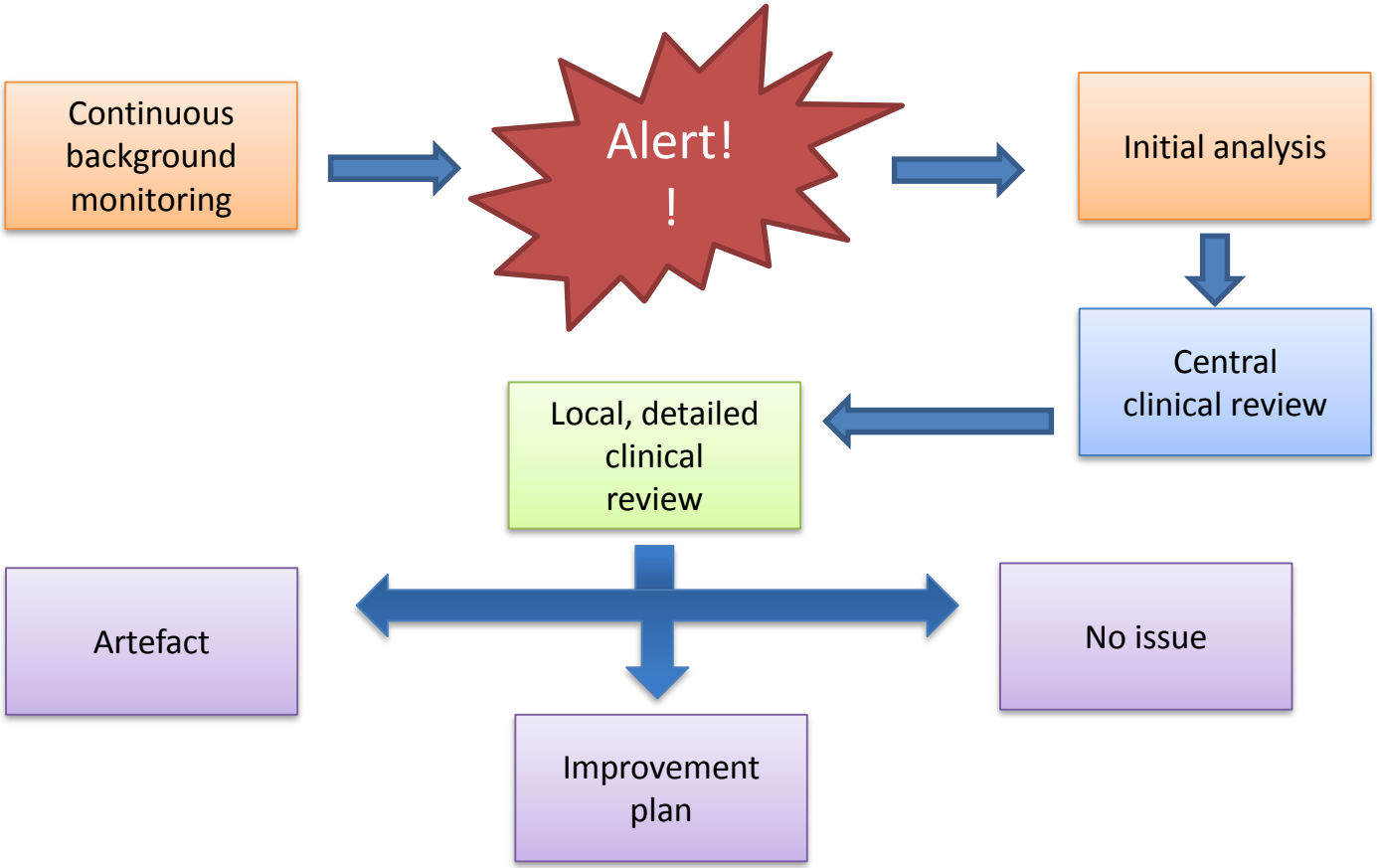
Extrinsic reference

- Works well for surveillance systems
- Spots “out of control” in near real time

Statistically relevant variation in “real” time



Responding to alerts in real time



Thanks for listening

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