Health Innovation Manchester

NHS

Utilisation Management Unit

# MINDFUL ANALYTICS

Data does not speak for itself

DISCOVER

IMPROVE

EVALUATE

CHANGE

NHS

Utilisation Management Unit

Blending clinical and analytical expertise to support health and care systems improve patient pathways, experience and outcomes.

DISCOVER

IMPROVE

EVALUATE

CHANGE

# What is the data worth?

- We collect data to enable us to answer questions, evaluate outcomes and make predictions about future probabilities and trends
- Ultimately we use data to inform decisions
- We live in an ‘information age’ with more data than we have ever had before
- But it is useless until we know how to make sense of it and how to apply it

The main failure to delivering data driven decision-making is not lack of data but flawed thinking

Our irrational human brains are the best sense-making devices we have

But, we are prone to cognitive bias and illusions

More data means we have to be mindful of what the evidence is worth

By nature we are storytelling creatures, drawn to seeing patterns

# Urgent and Emergency Care

Urgent and Emergency care is awash with data

Multiple data sources, myriad of dashboards, score cards and performance reports

Health Care systems looking for the holy grail of ‘One Version of the Truth’

We are pleased with ‘facts’, visualisations depicting changes and comparisons, however we need to be aware of the data that underpins these in order to make good decisions

“The numbers have no way of speaking for themselves. We speak for them. We imbue them with meaning.”

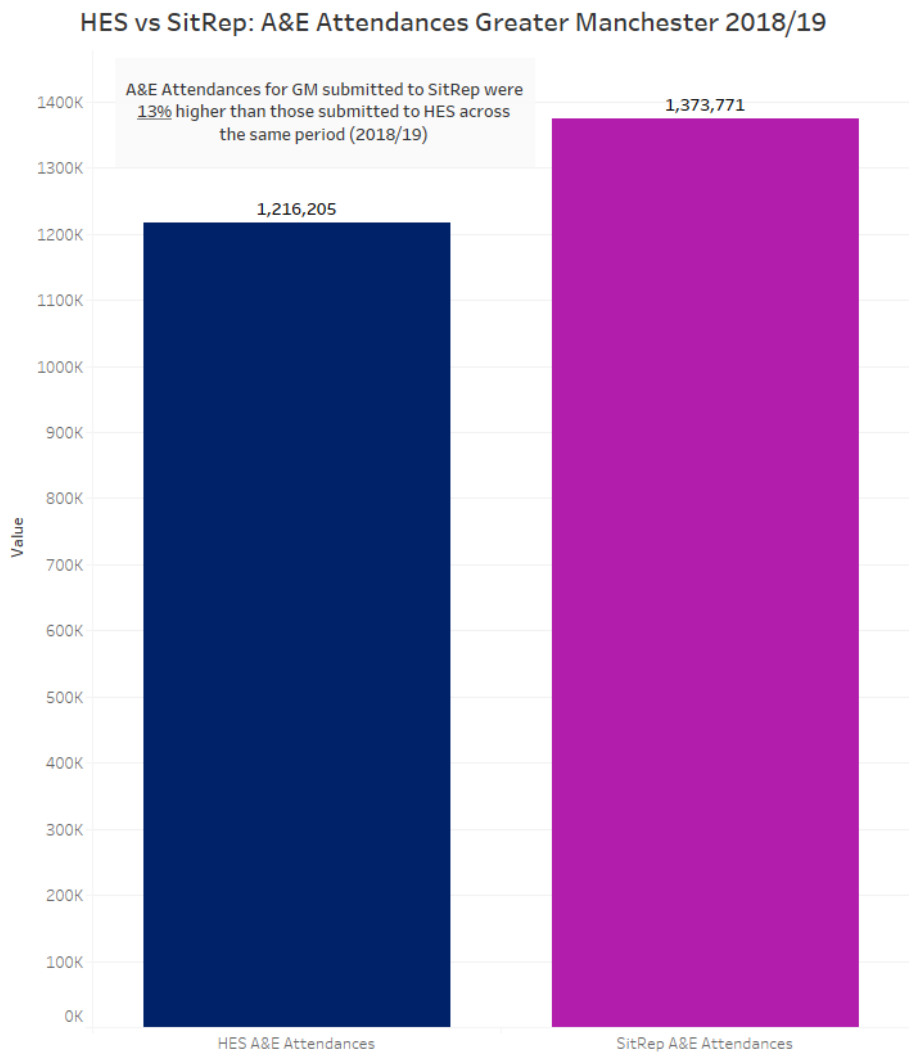
Nate Silver, The Signal and the Noise (Penguin, 2012)
from The Art of Statistics Learning from Data
David Spiegelhalter

# Data source considerations

- Definitions
- Selective and small samples
- Data quality and completeness

Conclusions from data will not be valid if definitions are not applied consistently or data is incomplete

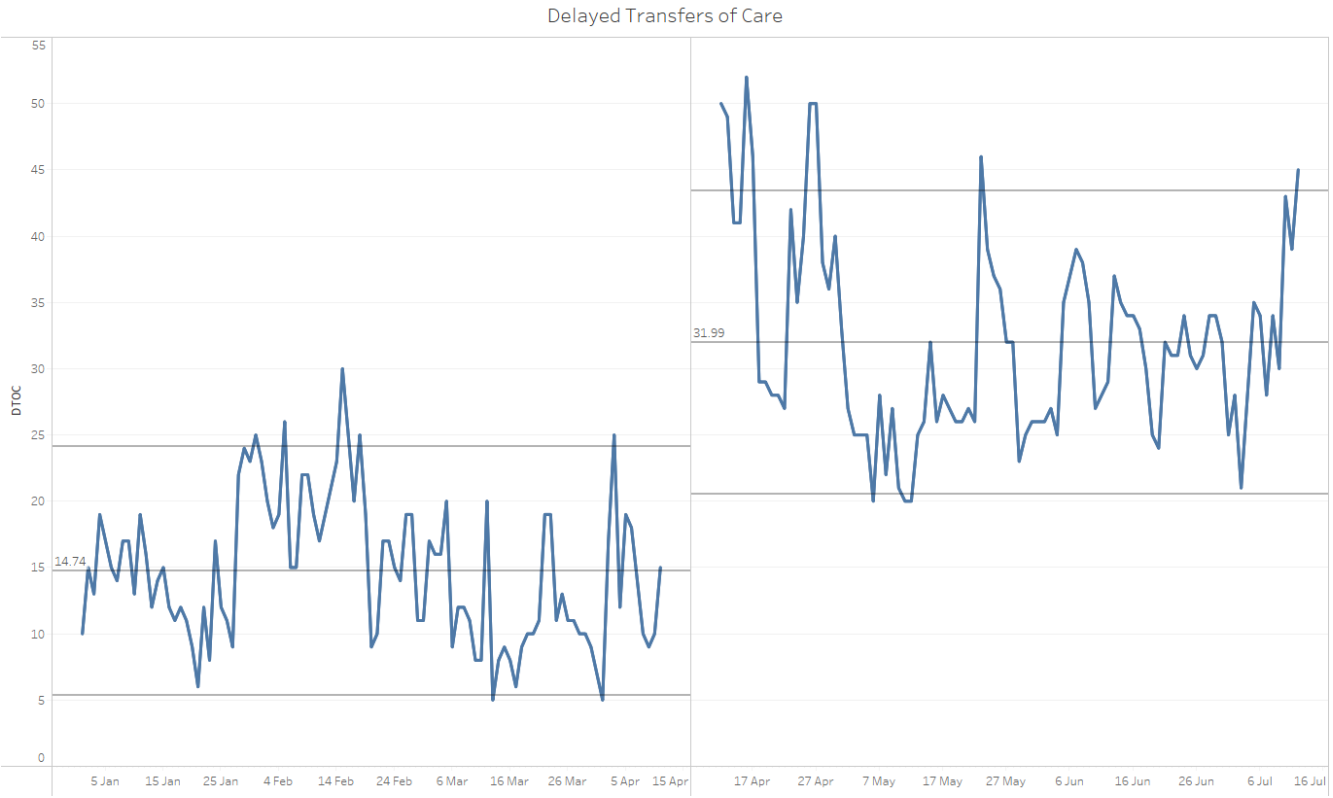
# Data source considerations



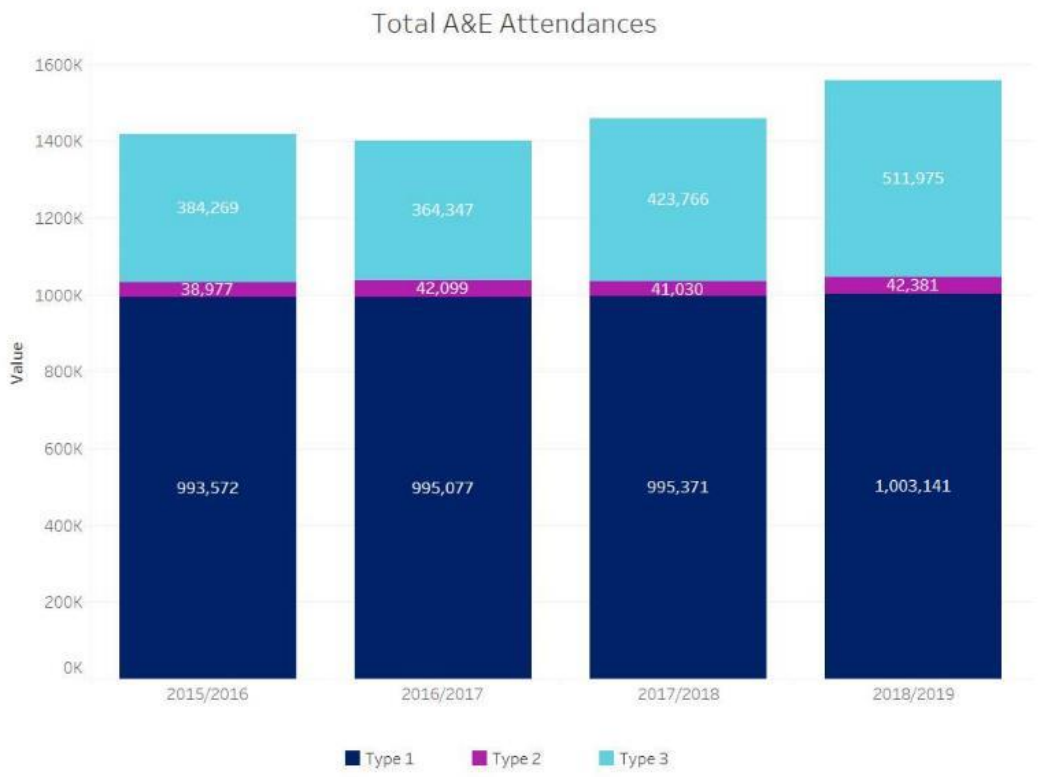

- Both HES and SitRep count A&E attendances
- But SitRep has 13% more attendances recorded than HES
- Need to be aware of what is and is not included in data
- Compare like for like

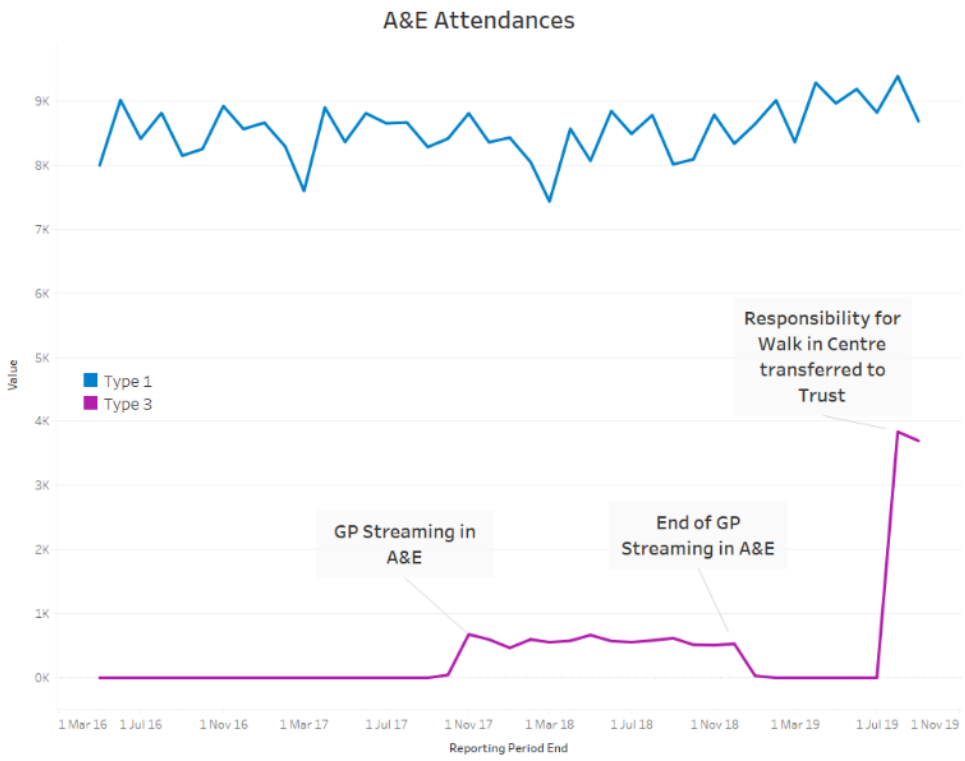
# Data source considerations

- Application of definitions may change over time, even within an organisation
- Delayed transfers of care are a prime example
- Shift in definition can be seen by a step change in the reported figures



# Data source considerations

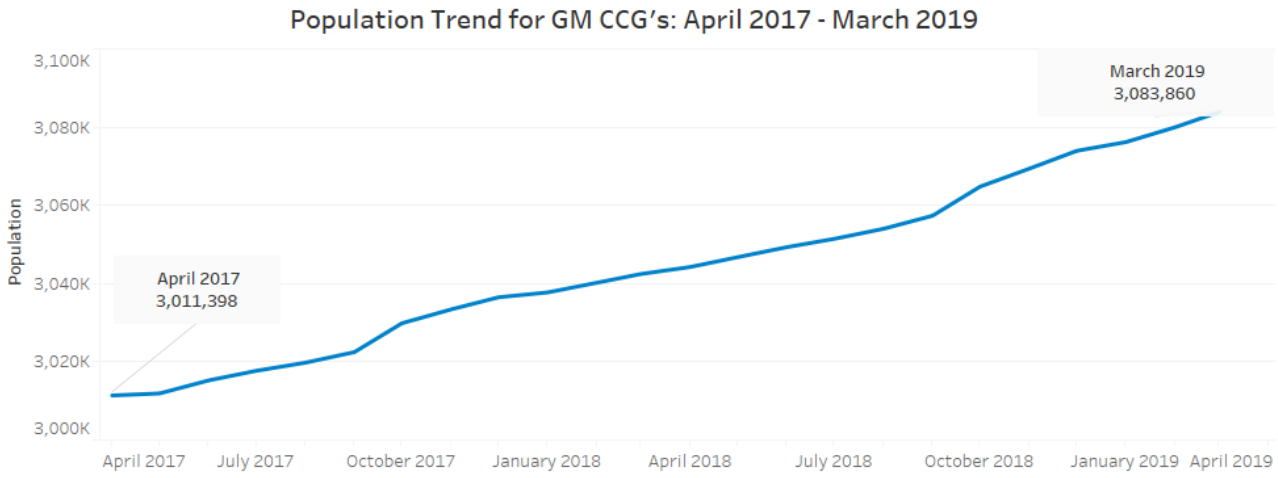


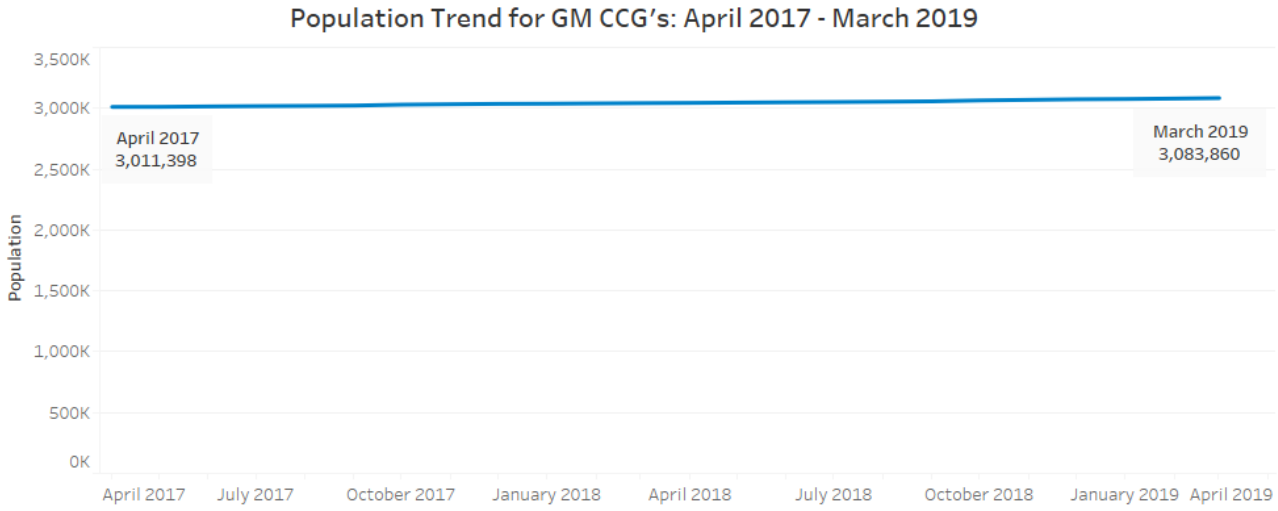




Total attendances have increased…

…but how much of this is natural growth and how much is due to changes in systems?

# Truncated Vertical Axis

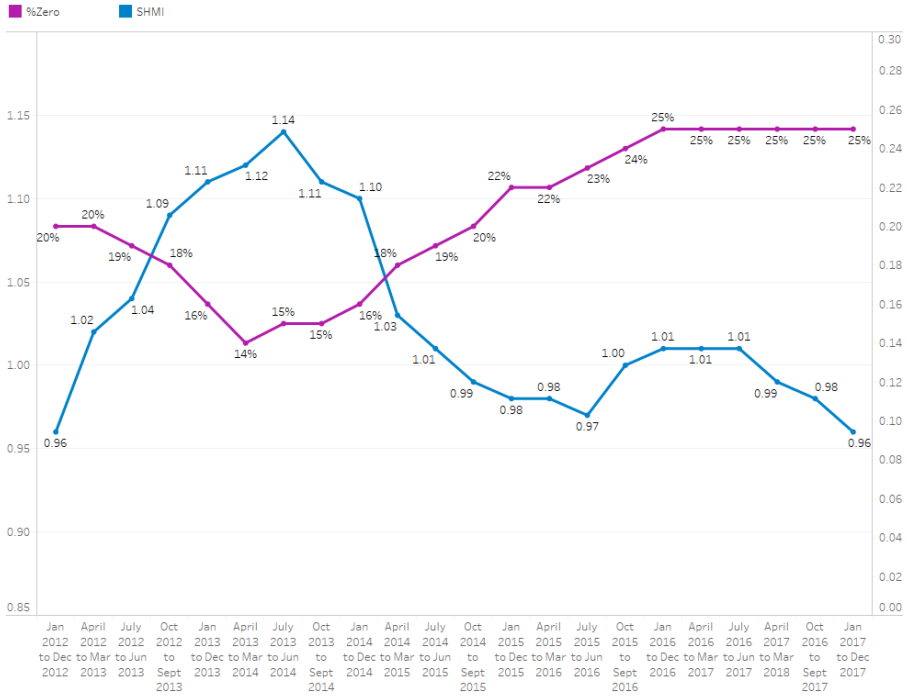


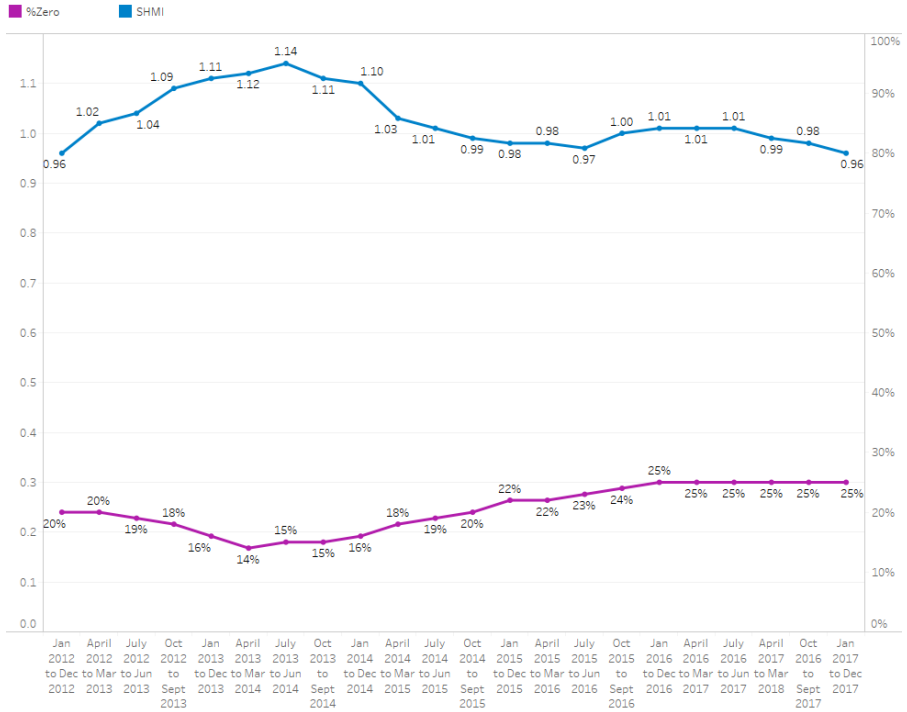




- Chart appears to show a dramatic increase in population
- However, the y axis does not start at 0
- Starting the axis at 0 means that the same increase in population does not appear as dramatic

# Dual axis – second axis can be scaled any way you want

What is the relationship between AEC activity & mortality?




- Second axis can be scaled any way you want – in this case so that the lines cross
- Chart title wording is leading as suggests there is a relationship

- There might be a relationship but this chart does not demonstrate it
- Only the choice of axis scale and title wording leads the mind to this conclusion – illusory correlation

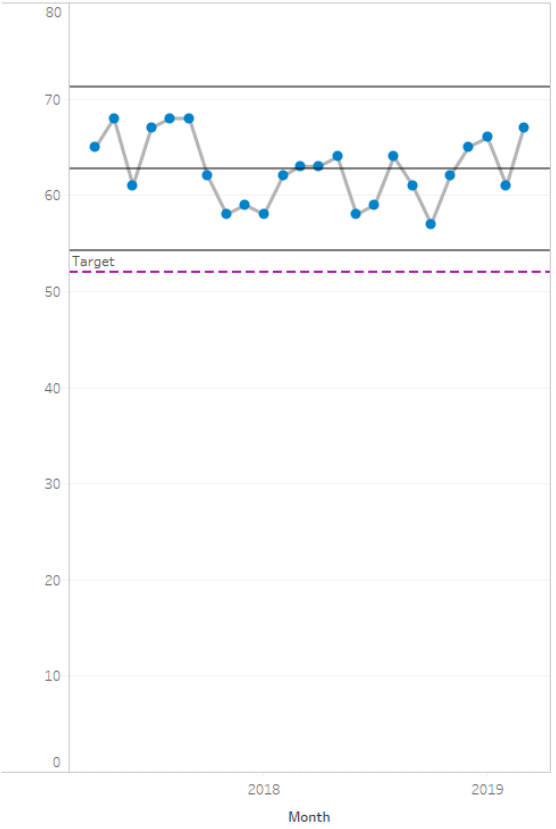
# SPC

Metric by Site

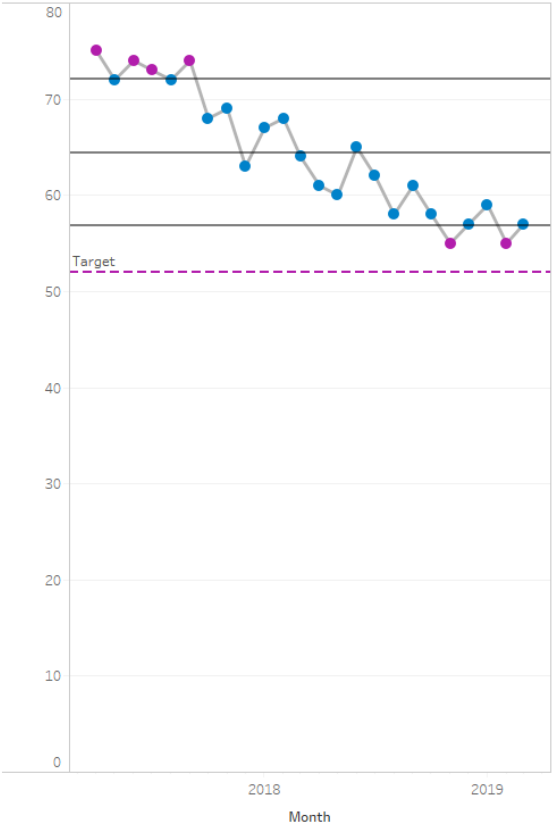
| | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site 1 | 63 | 64 | 58 | 59 | 64 | 61 | 57 | 62 | 65 | 66 | 61 | 67 |
| Site 2 | 61 | 60 | 65 | 62 | 58 | 61 | 58 | 55 | 57 | 59 | 55 | 57 |

All months above target (55) for both sites. It's green so it's ok?

Site 1: Metric against target




Site 2: Metric against target




Site 1

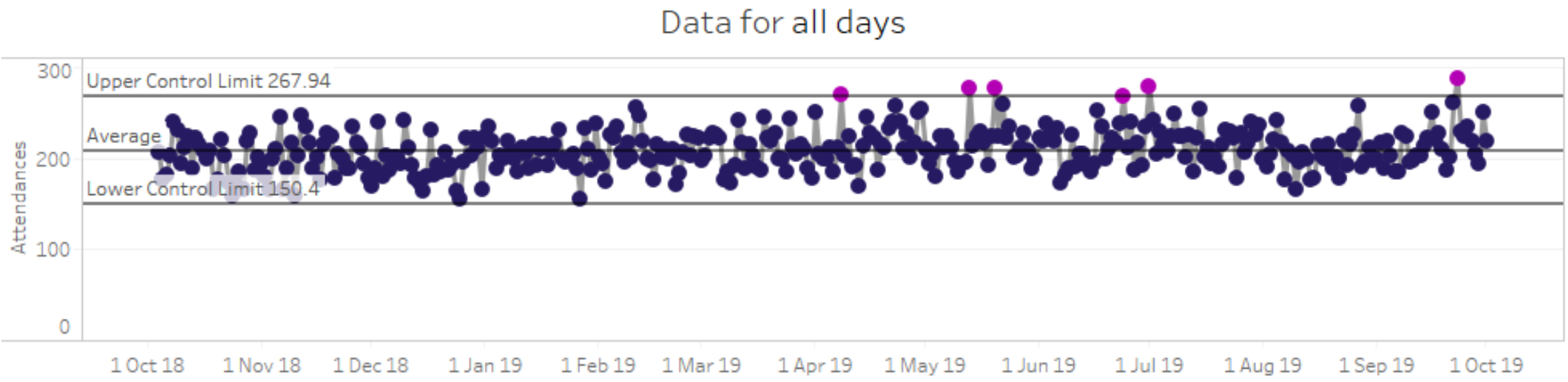
- Stable
- In control

Site 2

- Decreasing trend
- A cause for concern?

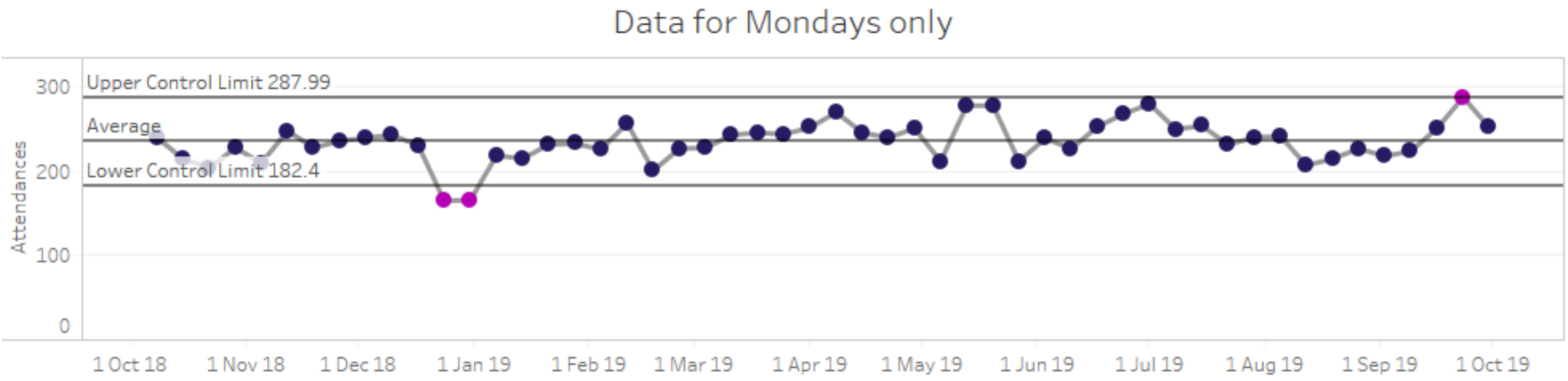
Data presentation can cause issues to be overlooked

# SPC




Need to compare like for like. For example, all significantly high days are Mondays….

…but not all Mondays are significantly high when comparing like for like

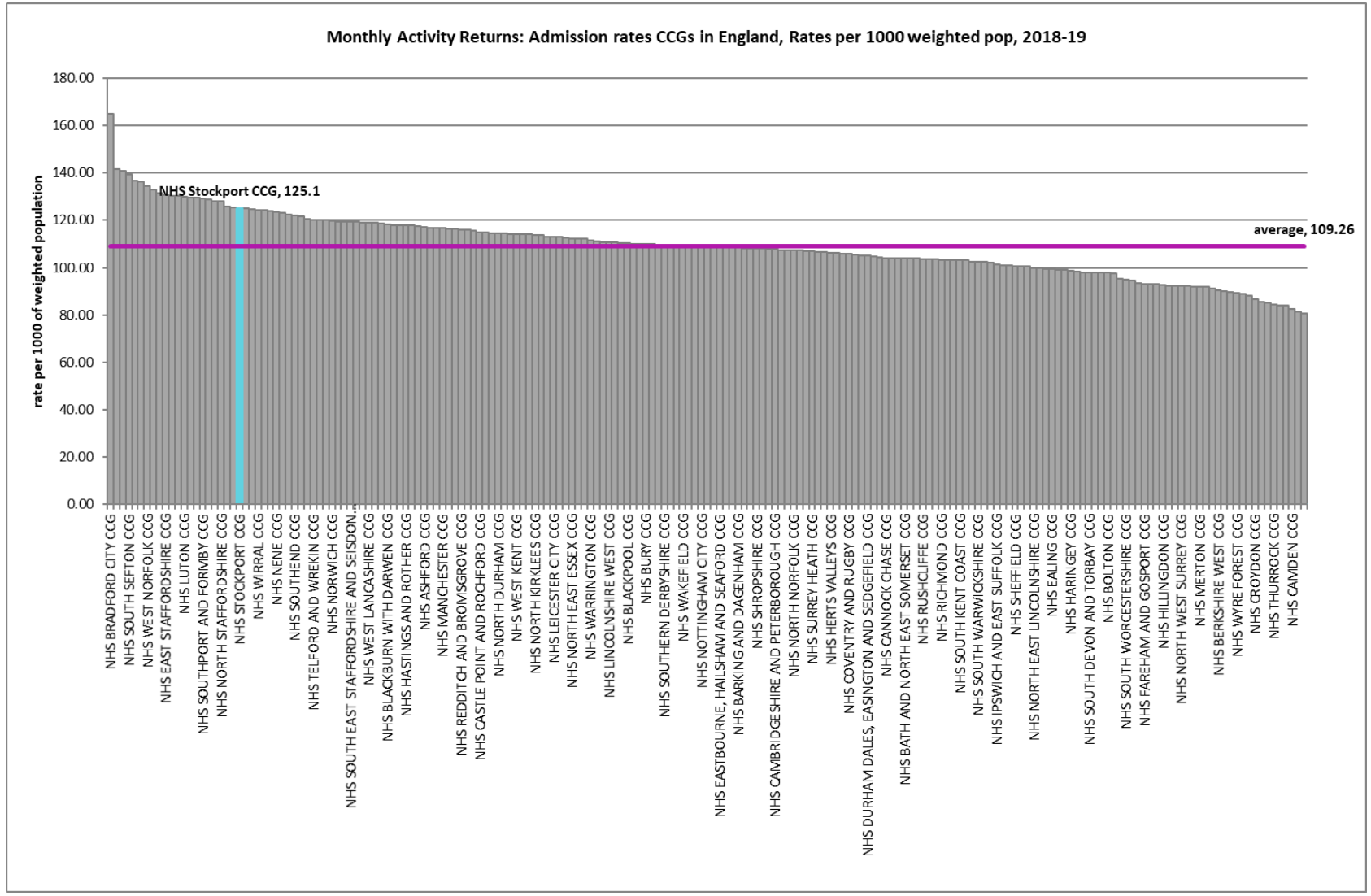


# Benchmarking across organisations

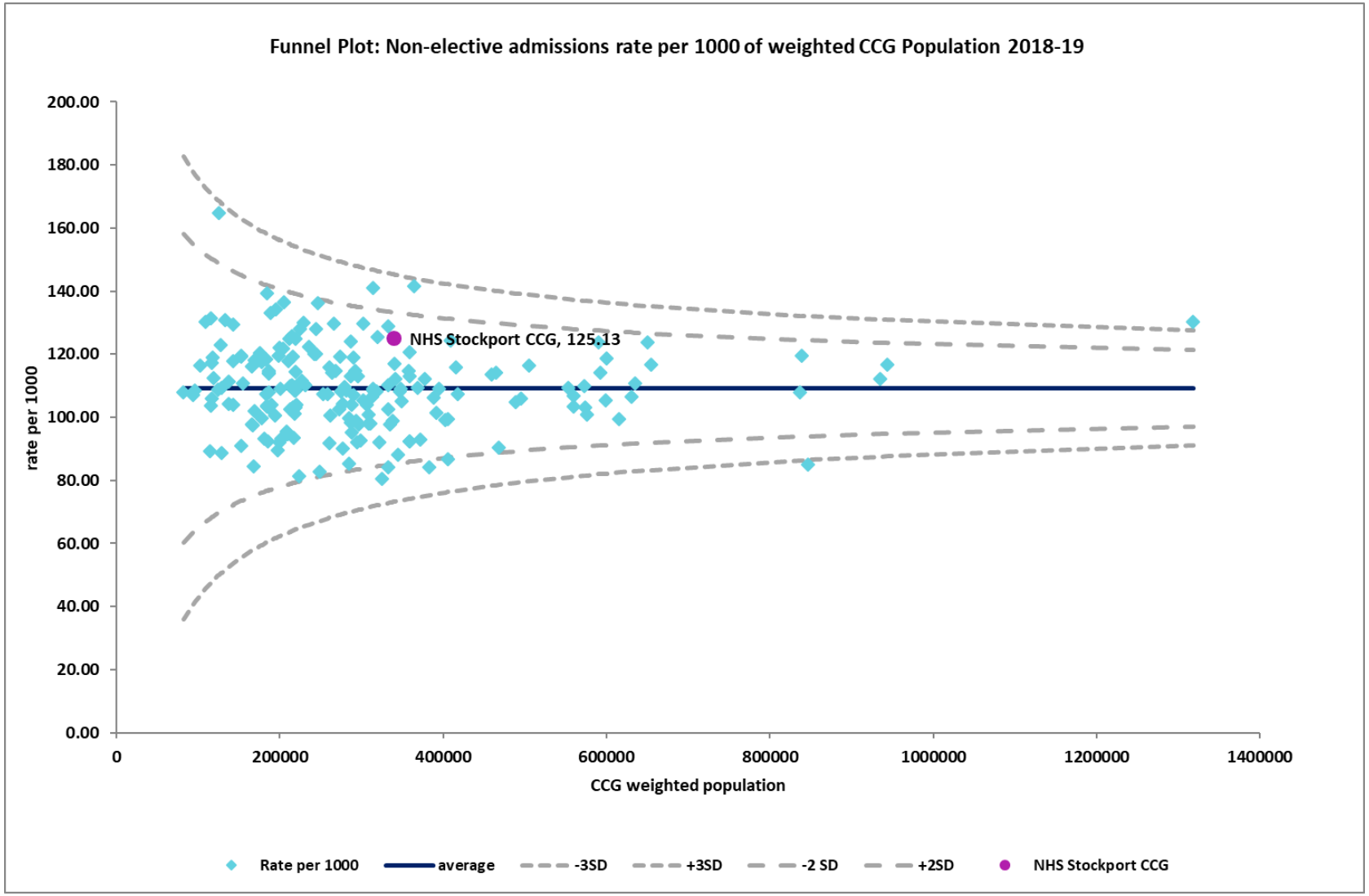
- Number of emergency admissions by CCG
- When comparing organisations we cannot use absolute numbers because population sizes and demographics vary
- Crude weights per 1000 of population adjust for size but not other factors that affect admission rates i.e. age and deprivation

Weighted population adjusts for these factors so we are comparing ‘like with like’

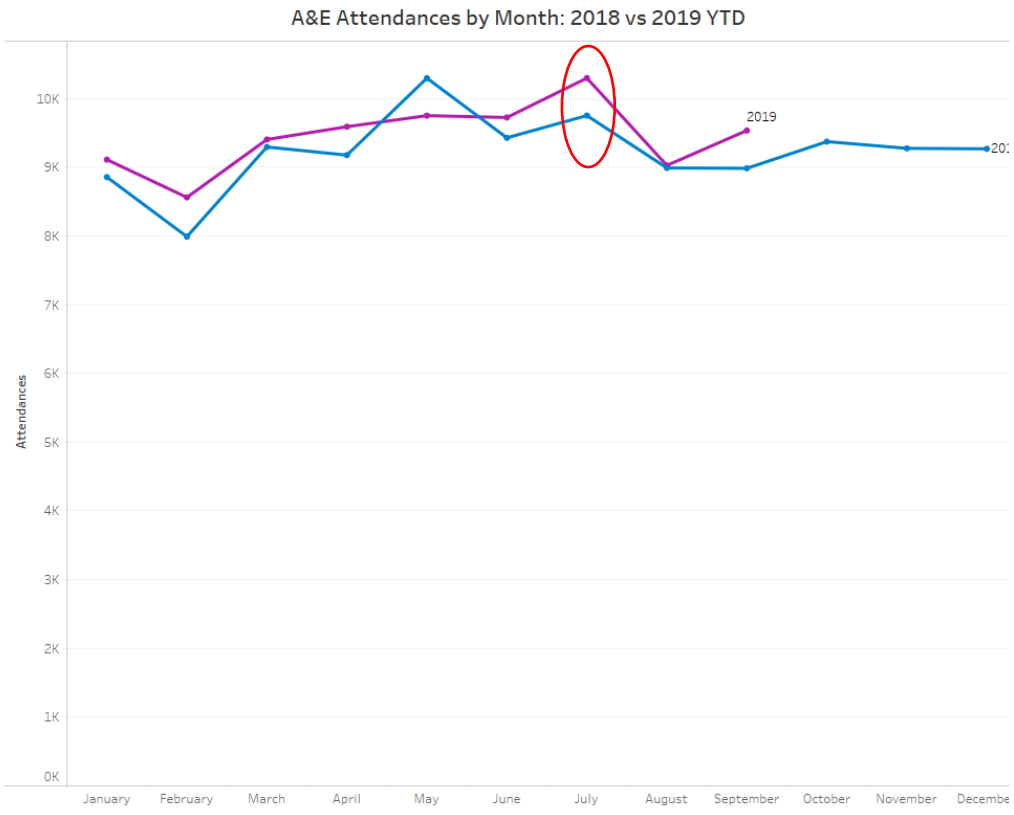
# Organisation Comparisons: Ranking

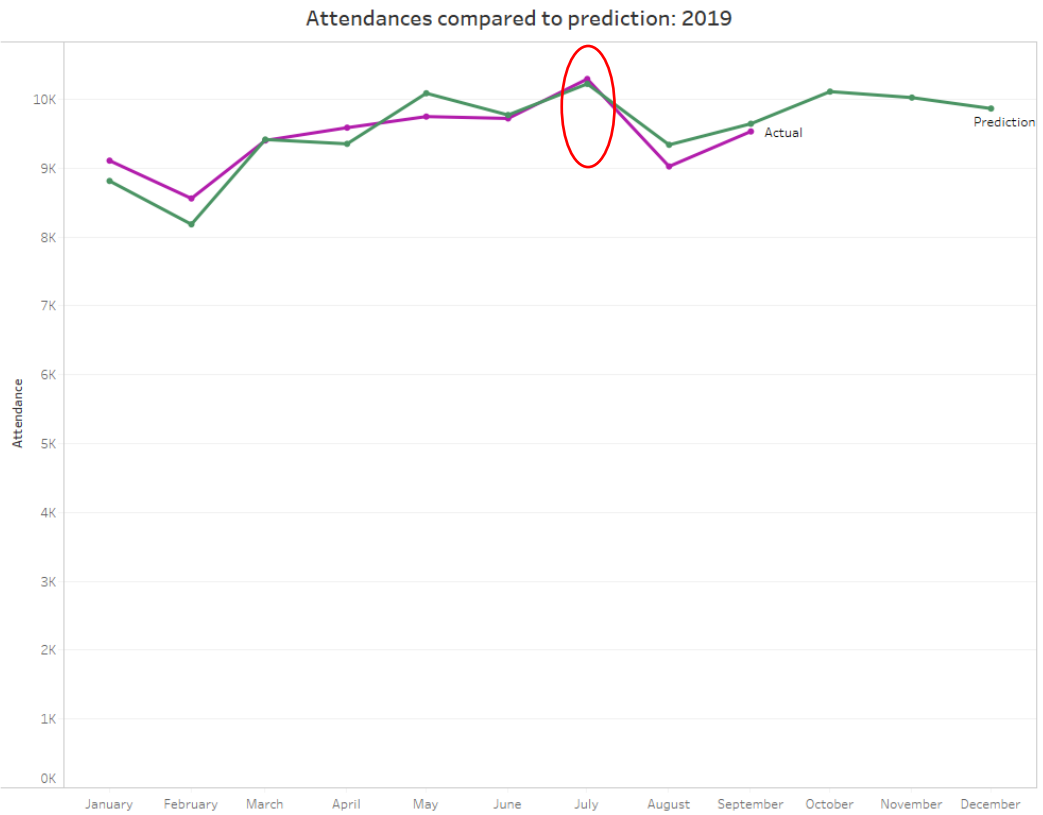


# Organisation Comparisons: Funnel Plot



# Ignoring trend and seasonality

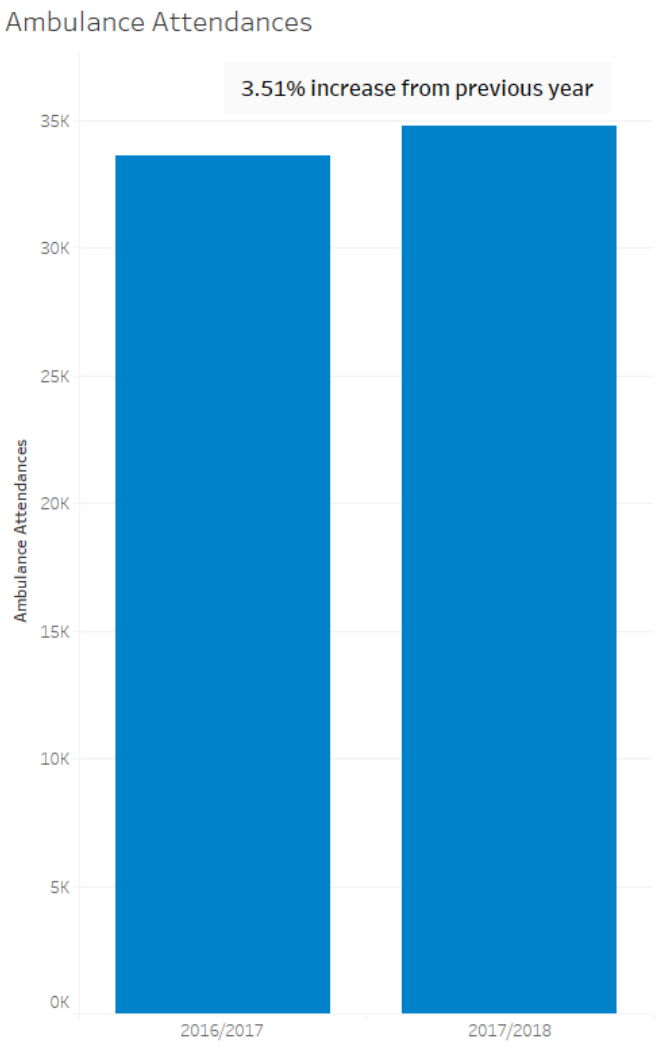


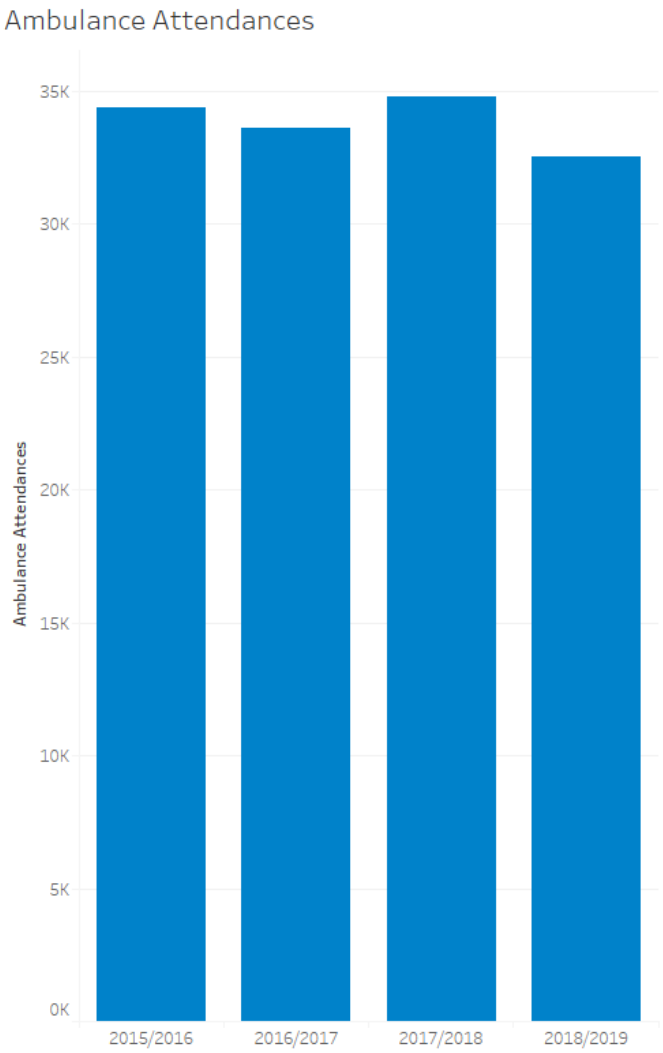




Attendances will always appear high if we ignore trends and focus on comparisons with last year

Predictions based on trends and seasonality better prepare systems for expected activity levels

# Ignoring trend and seasonality: Regression to the mean

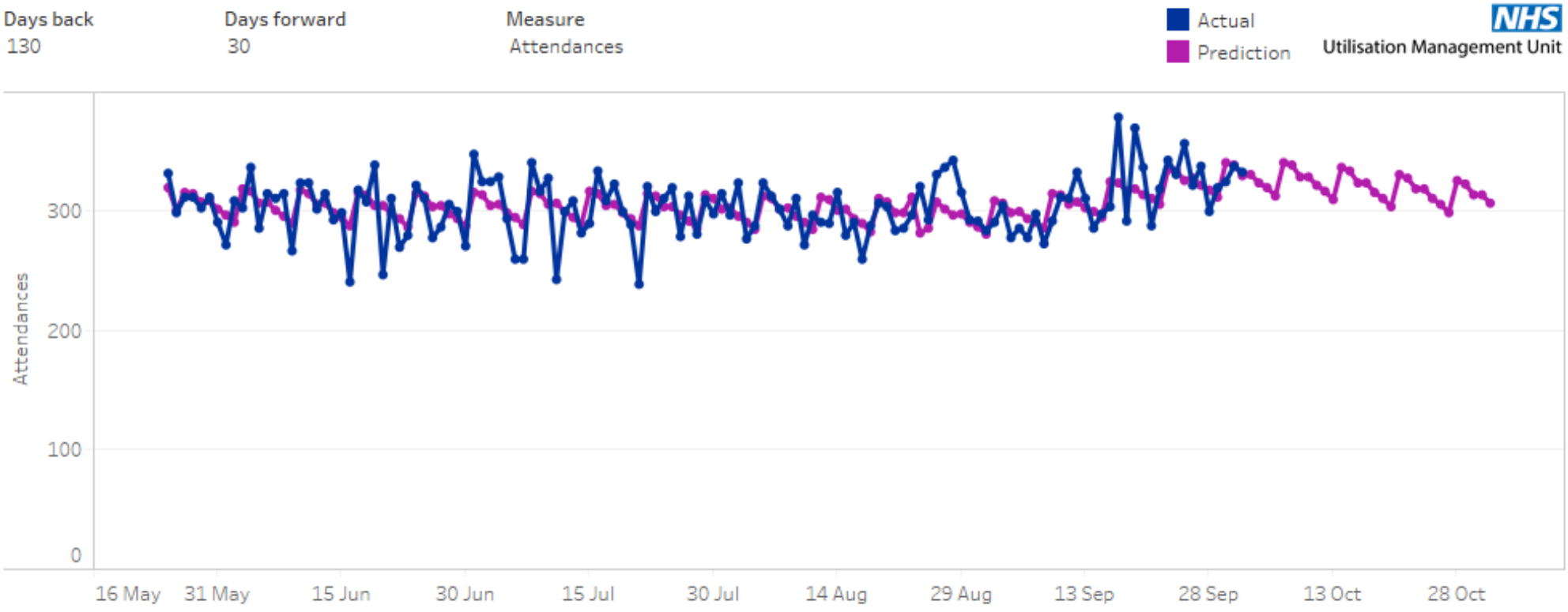



Comparing 2 points in isolation can exaggerate changes

Looking at a longer time period gives context

# Build in trend and seasonality



# Ignoring base rate

- Admissions from nursing homes
- Only 5% of over 65-year-olds are in nursing homes
- So even if people in nursing homes have a higher likelihood of being admitted to hospital they will not make up a sizeable proportion of overall admissions

- Mental Health ED attendances
- Only 1% of ED attendances have a primary diagnosis of a mental health condition
- Complex to manage but do not make up a sizeable proportion of activity

# Conclusion leaps – ignoring more likely alternative explanations

*"To the credit of NHS staff over the past five years, on a like-for-like basis, a patient's chance of having to be admitted to hospital as an emergency has fallen by 12%"*

https://www.longtermplan.nhs.uk/online-version/chapter-1-a-new-service-model-for-the-21st-century/2-the-nhs-will-reduce-pressure-on-emergency-hospital-services/#ref

Alternative:

- Change in recording coincides with the development of ambulatory emergency care pathways
- Capacity constraints i.e. no more beds to admit to
- Patients are now spending longer in ED

# Machine Learning

- Machine learning techniques are excellent at identifying patterns in data, but they require good quality data and domain knowledge to infer meaning
- AI or Machine Learning won't overcome poor data quality, any patterns found will be useless or even dangerous
- New techniques don't replace our understanding, they need to be supplemented with local intelligence

Key Indicators - Threshold Values

| | Ambulance Attendances | Attendances | Total Emergency Admissions | 7 Day Stranded Patients | 21 Day Stranded Patients | Bed Occupancy |
|---|---|---|---|---|---|---|
| Site 1 | 87 | 275 | | 231 | | |
| Site 2 | | | | 129 | 50 | 89.50% |
| Site 3 | | | 55 | 87 | | 83.50% |

# Key messages

1. Know the limitations of the data source, and understand base rates
2. Adjust for confounding variables such as age and deprivation to ensure measuring the differences of interest
3. Use statistical techniques such as SPC charts and funnel plots to identify differences rather than RAG rating and league tables
4. Use predictive analysis rather than comparing to last year, be aware of trend and seasonality
5. Be mindful of natural tendency to conclude causation when it does not exist

# Key messages

There needs to be an appreciation that the data can only illuminate, it requires expert and domain knowledge to turn into robust, sense-making information to underpin decision making

Managers and clinicians need to work together with analysts to turn data into actionable intelligence

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# Thank you

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