



# The problem with red, amber, green

Jacob Anhøj  
Consultant, DIT  
Rigshospitalet  
@JacobAnhoej

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# BMJ on data

## BMJ Quality & Safety januar 2017

- Mountford, Wakefield: From stoplight reports to time series
- Schmidtke, Poots, Carpio, Vlaev, Kandala, Lilford: Considering chance in quality and safety performance measures
- Anhøj, Hellesøe: The problem with red, amber, green



# Walter A Shewhart on data

*Rule 1: Original data should be presented in a way that will preserve the evidence in the original data for all the predictions assumed to be useful.*

*Rule 2: Any summary of a distribution of numbers in terms of symmetric functions should not give an objective degree of belief in any one of the inferences or predictions to be made therefrom that would cause human action significantly different from what this action would be if the original distributions had been taken as evidence.*



[Walter A Shewhart \(1939\). Statistical method from the viewpoint of quality control](#)

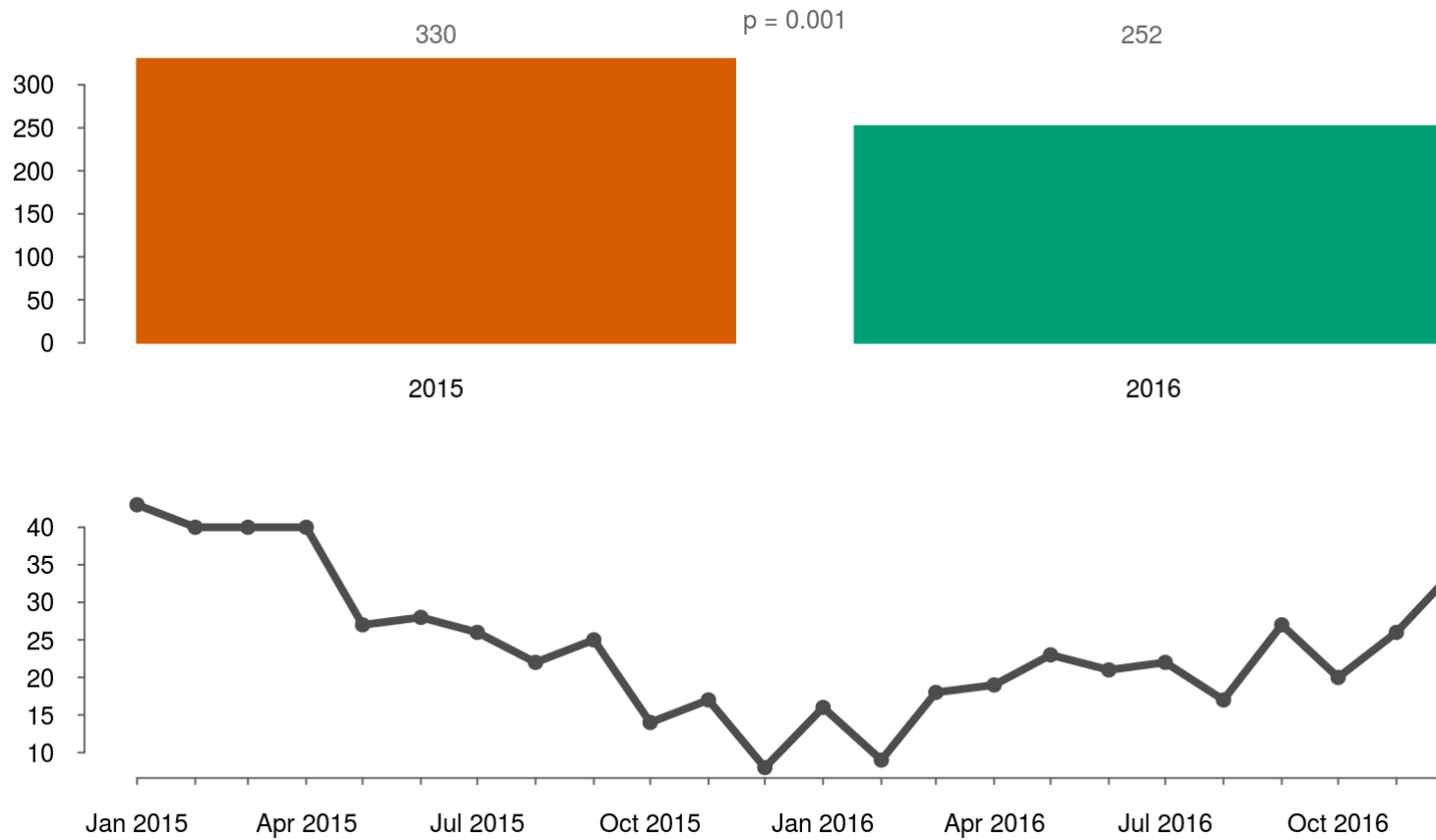
# W Edwards Deming on data

*Scientific data are not taken for museum purposes; they are taken as a basis for doing something. If nothing is to be done with the data, then there is no use collecting any. The ultimate purpose of taking data is to provide a basis for action or a recommendation for action. The step intermediate between the collection of data and the action is prediction.*



W Edwards Deming (1942): Journal of the American Statistical Association, 37/218

# Status quo or quo vadis?



# Everything is process

**Process:** Linked activities that work together to produce an outcome.

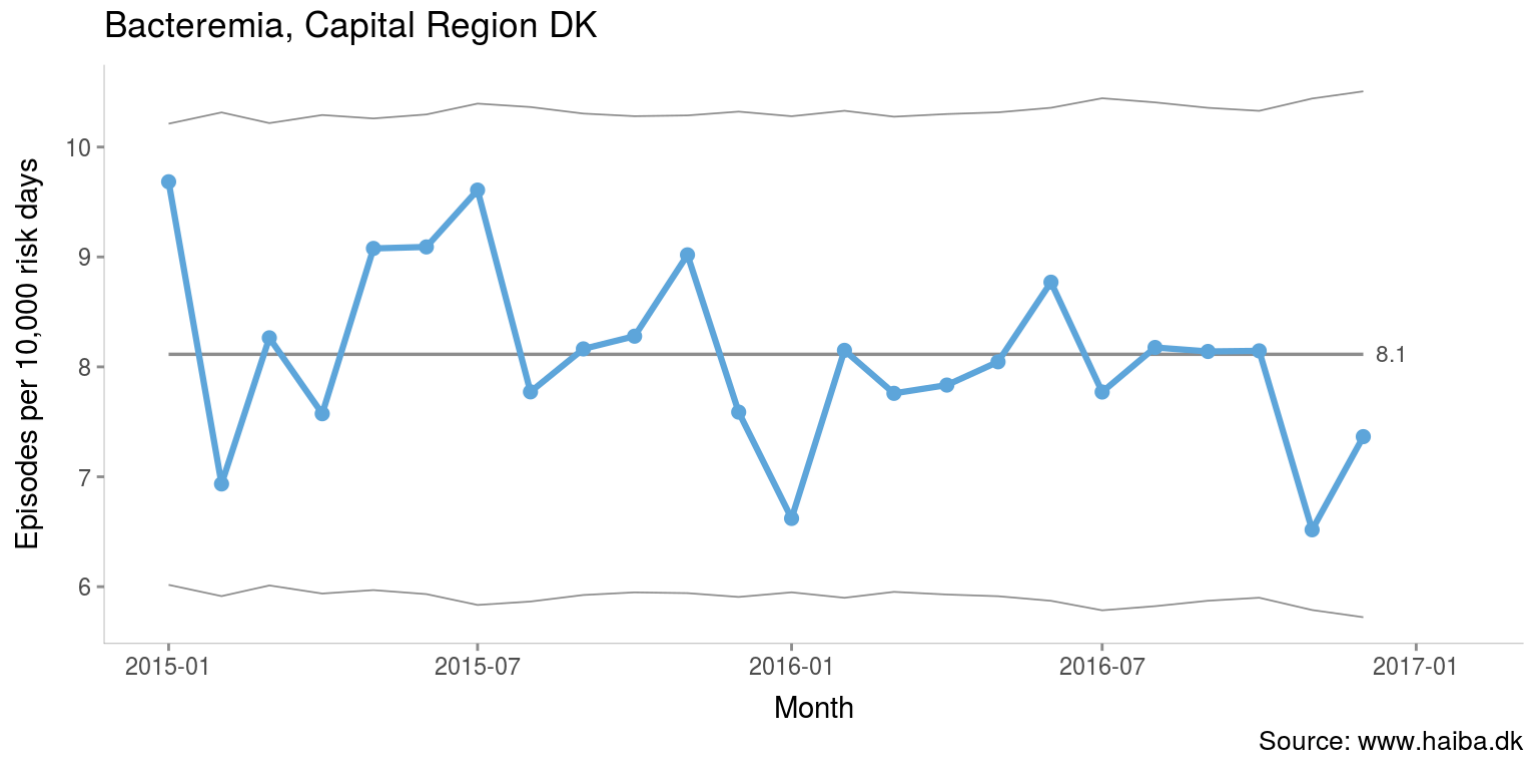
Processes vary

- **Random variation** is present in all processes and comes from forces that are constantly active within the system making the process stable and predictable.
- **Non-random variation** is present in some processes and comes from forces outside the historical process that suddenly act on the system making the process unstable and unpredictable.

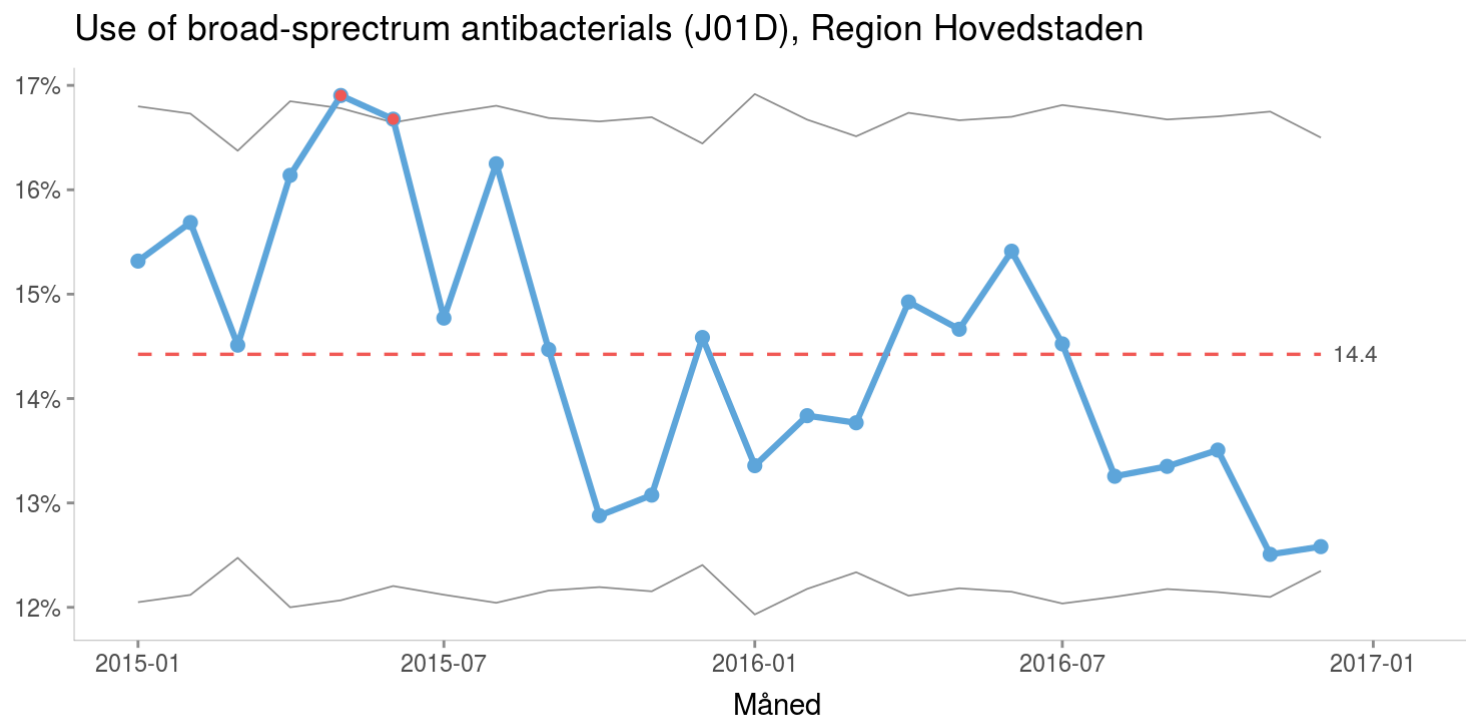


[Walter A Shewhart \(1931\). Economic control of quality of manufactured product](#)

# Random variation according to Shewhart



# Non-random variation according to Shewhart



Source: Region Hovedstaden

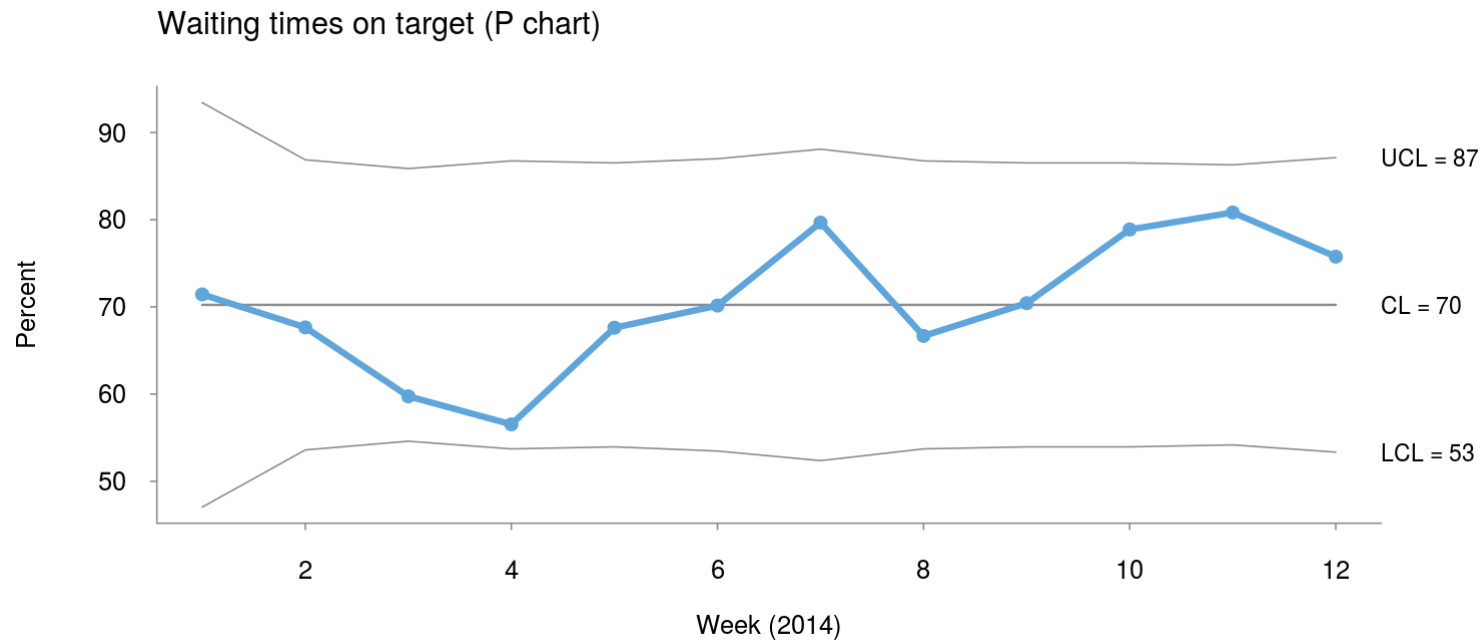


# Waiting times in the voice of the customer

|      |     | Værdier              | StatusNavn          |                      |                     |               |             |
|------|-----|----------------------|---------------------|----------------------|---------------------|---------------|-------------|
|      |     | Procent              |                     | Antal                |                     | Total Procent | Total Antal |
| ÅR   | Uge | Inden for forløbstid | Uden for forløbstid | Inden for forløbstid | Uden for forløbstid |               |             |
| 2014 | 1   | 71%                  | 29%                 | 25                   | 10                  | 100%          | 35          |
|      | 2   | 68%                  | 32%                 | 46                   | 22                  | 100%          | 68          |
|      | 3   | 60%                  | 40%                 | 46                   | 31                  | 100%          | 77          |
|      | 4   | 57%                  | 43%                 | 39                   | 30                  | 100%          | 69          |
|      | 5   | 68%                  | 32%                 | 48                   | 23                  | 100%          | 71          |
|      | 6   | 70%                  | 30%                 | 47                   | 20                  | 100%          | 67          |
|      | 7   | 80%                  | 20%                 | 47                   | 12                  | 100%          | 59          |
|      | 8   | 67%                  | 33%                 | 46                   | 23                  | 100%          | 69          |
|      | 9   | 70%                  | 30%                 | 50                   | 21                  | 100%          | 71          |
|      | 10  | 73%                  | 27%                 | 56                   | 21                  | 100%          | 77          |
|      | 11  | 81%                  | 19%                 | 59                   | 14                  | 100%          | 73          |
|      | 12  | 76%                  | 24%                 | 50                   | 16                  | 100%          | 66          |

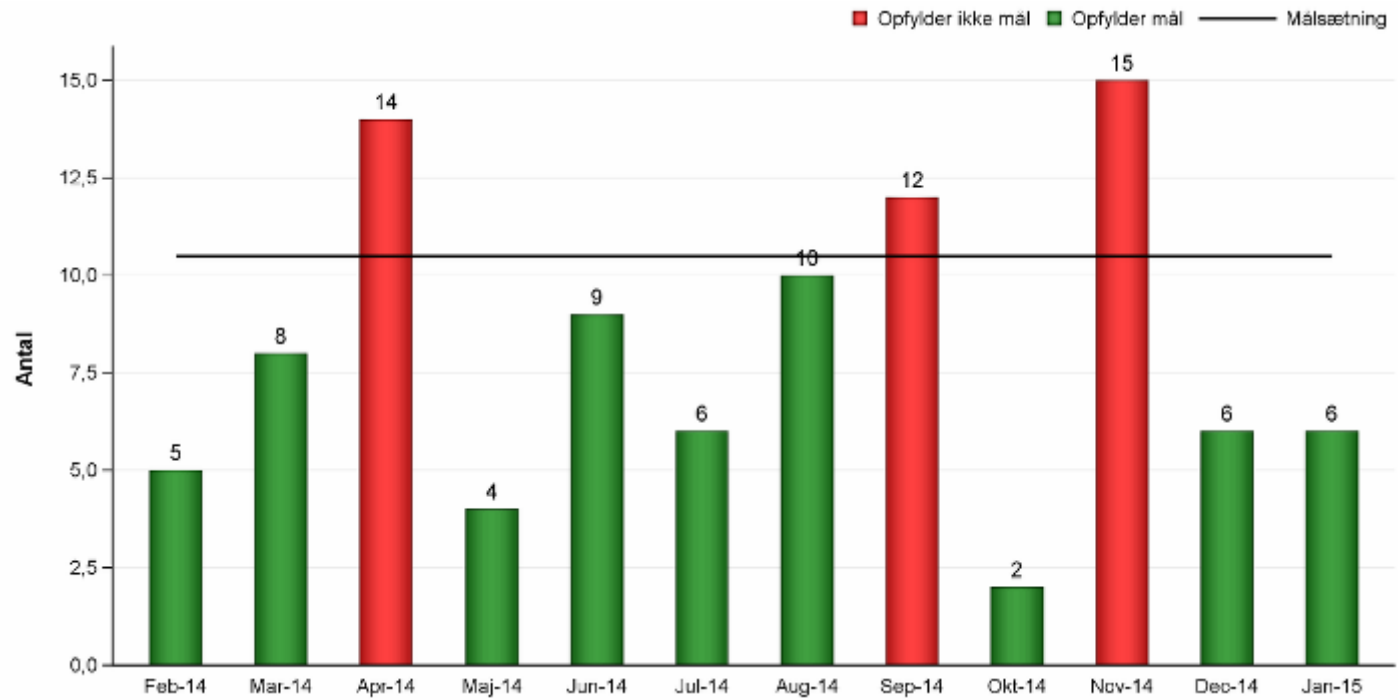
Rigshospitalet (2014)

# Waiting times in the voice of the process



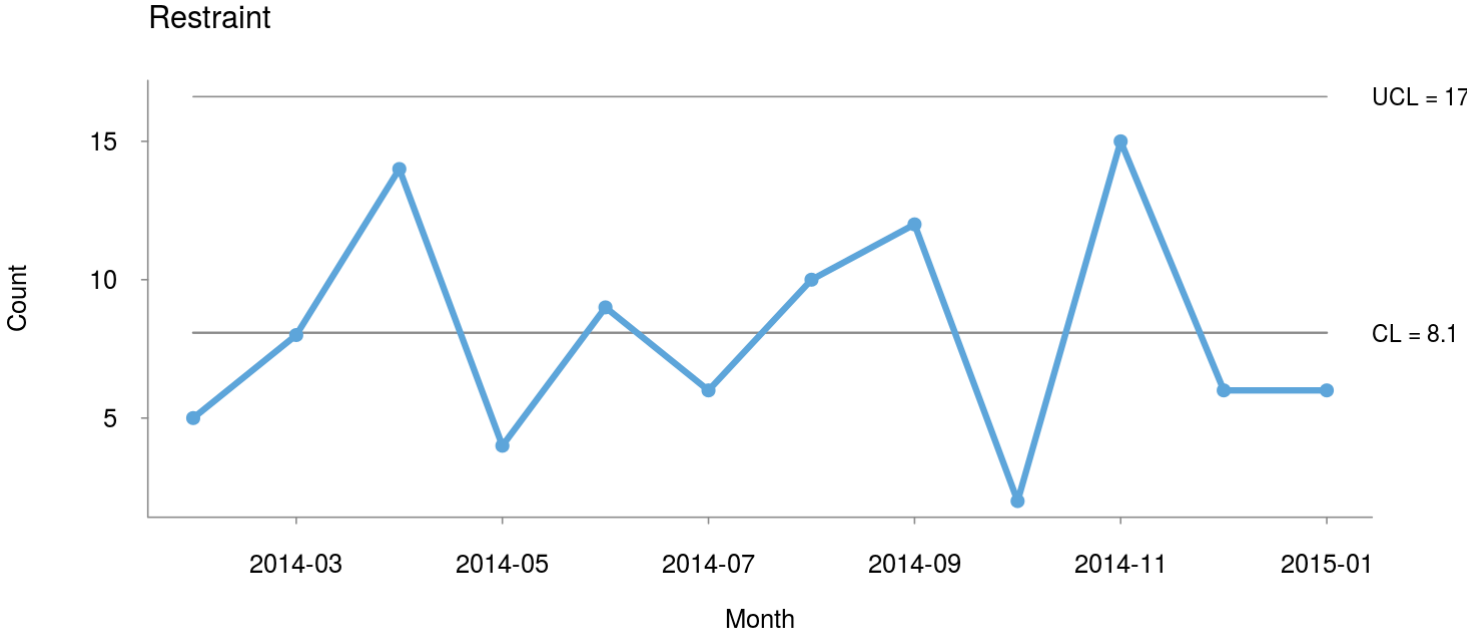
Rigshospitalet (2014)

# Restraint in the voice of the customer



Region Hovedstaden (feb. 2015)

# Restraint in the voice of the process



Region Hovedstaden (feb. 2015)

# From the Ministry of Silly Graphs

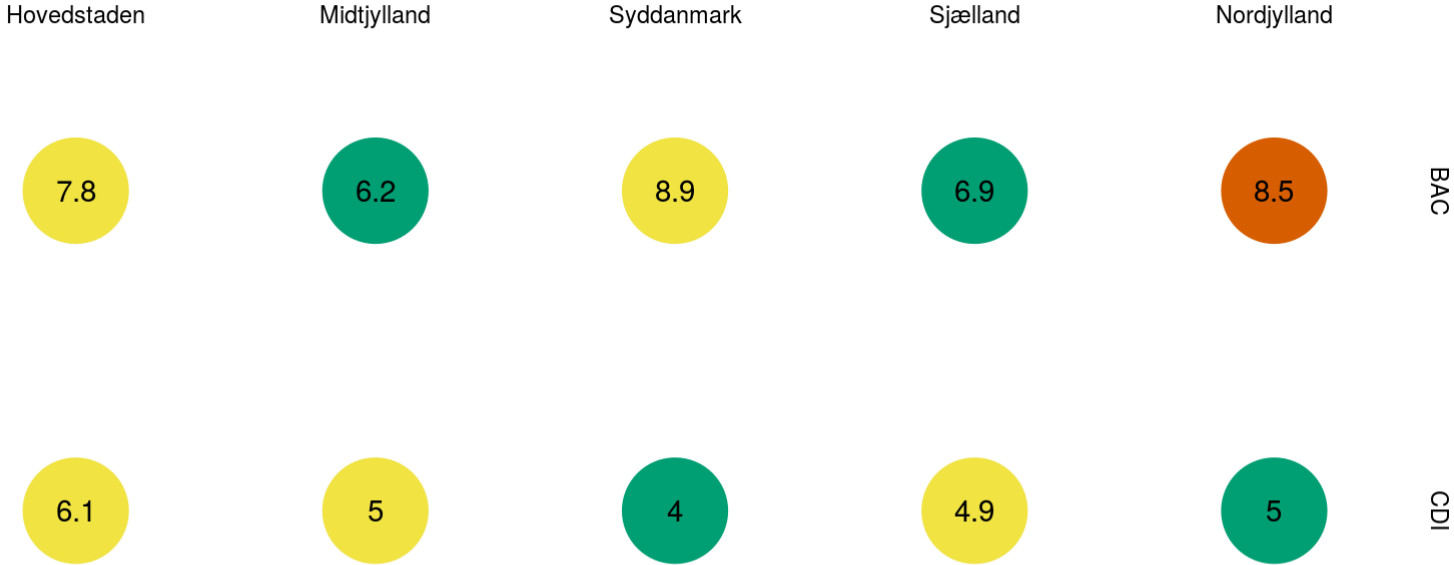
Better than average and better than last year: **Green**. Worse than average and worse than last year: **Red**. Otherwise: **Amber**

| REGION HOVEDSTADEN    | AKUTTE GEN-INDLÆGGELSER INDENFOR 30 DAGE, PCT. | VENTETID TIL GENOPTRÆNING, MEDIAN, DAGE | SOMATISK FÆRDIG-BEHANDLINGS-DAGE PÅ SYGEHUSENE, DAGE, PR. 1.000 BORGERE | AKUTTE INDLÆGGELSER PR. KOL-PATIENT, ANTAL PR. 1.000 PATIENTER | AKUTTE INDLÆGGELSER PR. DIABETES-PATIENT, ANTAL PR. 1.000 PATIENTER | FOREBYGGELIGE INDLÆGGELSER FOR ÆLDRE, ANTAL PR. 1.000 ÆLDRE | MIDDEL |
|-----------------------|------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------|--------|
| ALBERTSLUND KOMMUNE   | ● 7,7                                          | ● 15                                    | ● 5,8                                                                   | ● 762                                                          | ● 518                                                               | ● 89,4                                                      | ● 80,  |
| ALLERØD KOMMUNE       | ● 6,7                                          | ● 11                                    | ● 4,4                                                                   | ● 582                                                          | ● 390                                                               | ● 57,4                                                      | ● 82,  |
| BALLERUP KOMMUNE      | ● 4,9                                          | ● 15                                    | ● 13,2                                                                  | ● 673                                                          | ● 431                                                               | ● 72,9                                                      | ● 79,  |
| BORNHOLM KOMMUNE      | ● 6,5                                          | ● 19                                    | ● 1,5                                                                   | ● 690                                                          | ● 436                                                               | ● 69,3                                                      | ● 79,  |
| BRØNDBY KOMMUNE       | ● 6,4                                          | ● 21                                    | ● 42,9                                                                  | ● 832                                                          | ● 499                                                               | ● 96,3                                                      | ● 79,  |
| DRAGØR KOMMUNE        | ● 4,5                                          | ● 15                                    | ● 7,8                                                                   | ● 593                                                          | ● 407                                                               | ● 67,9                                                      | ● 81,  |
| EGEDAL KOMMUNE        | ● 4,7                                          | ● *                                     | ● 30,8                                                                  | ● 610                                                          | ● 402                                                               | ● 56,7                                                      | ● 81,  |
| FREDENSBORG KOMMUNE   | ● 9,3                                          | ● 14                                    | ● 10,3                                                                  | ● 667                                                          | ● 459                                                               | ● 74,9                                                      | ● 81,  |
| FREDERIKSBERG KOMMUNE | ● 6,8                                          | ● 21                                    | ● 0,3                                                                   | ● 777                                                          | ● 445                                                               | ● 88,5                                                      | ● 8,   |
| FREDERIKSSUND KOMMUNE | ● 10,1                                         | ● 13                                    | ● 7,2                                                                   | ● 757                                                          | ● 502                                                               | ● 85,6                                                      | ● 79,  |
| FURESØ KOMMUNE        | ● 2,9                                          | ● 9                                     | ● 32,2                                                                  | ● 561                                                          | ● 349                                                               | ● 54,8                                                      | ● 8,   |
| GENTOFTE KOMMUNE      | ● 2,5                                          | ● 11                                    | ● 21,1                                                                  | ● 592                                                          | ● 392                                                               | ● 69,6                                                      | ● 82,  |
| GLADSAXE KOMMUNE      | ● 4,9                                          | ● 36                                    | ● 7,9                                                                   | ● 662                                                          | ● 454                                                               | ● 74,6                                                      | ● 79,  |
| GLOSTRUP KOMMUNE      | ● 7,6                                          | ● 11                                    | ● 4,5                                                                   | ● 811                                                          | ● 517                                                               | ● 84,2                                                      | ● 79,  |

[SUM, KL, DR \(2016\). Nationale mål for sundhedsvæsenet](#)

# Hospital infections according to MoSG

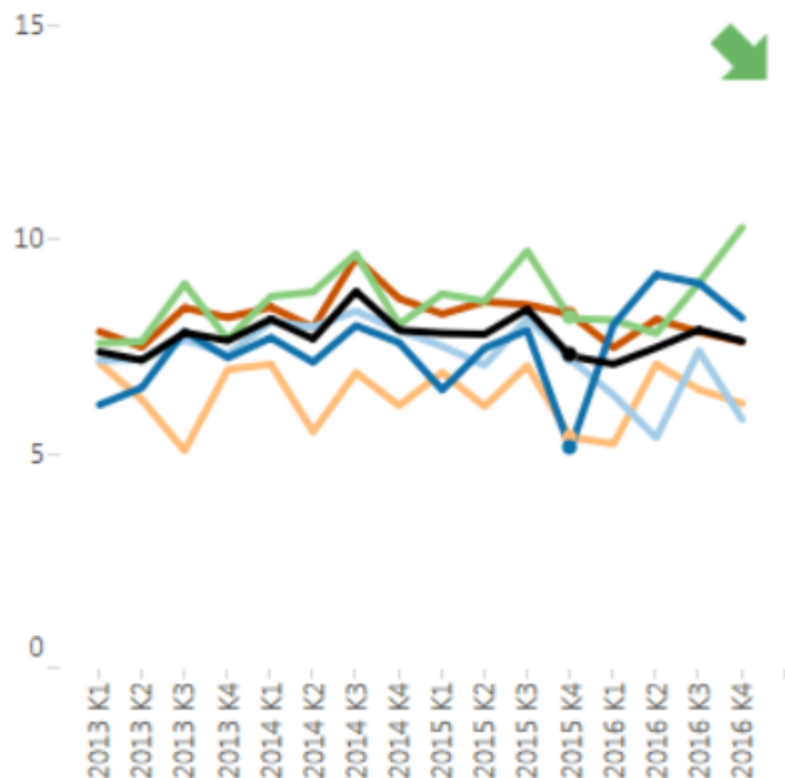
Hospital infections, DK 2015 - 2016



Episodes per 10,000 risk days, source: [www.haiba.dk](http://www.haiba.dk)

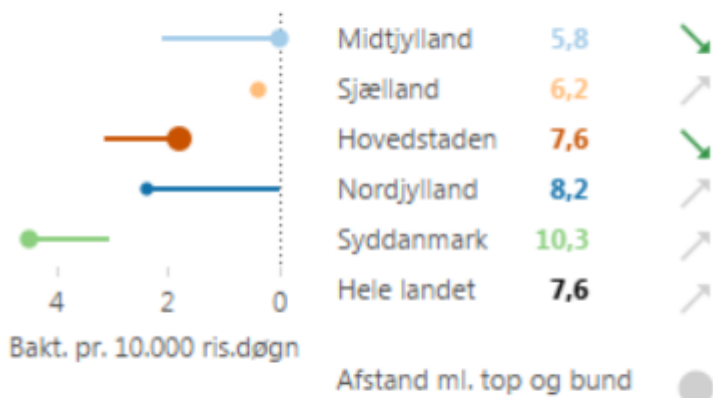
# HAls according to Danish Regions

Bakteriæmi (bakterier i blodet) pr. 10.000 risikodøgn



Afstand fra bedste

Prikstørrelse udtrykker volumen



Seneste måling

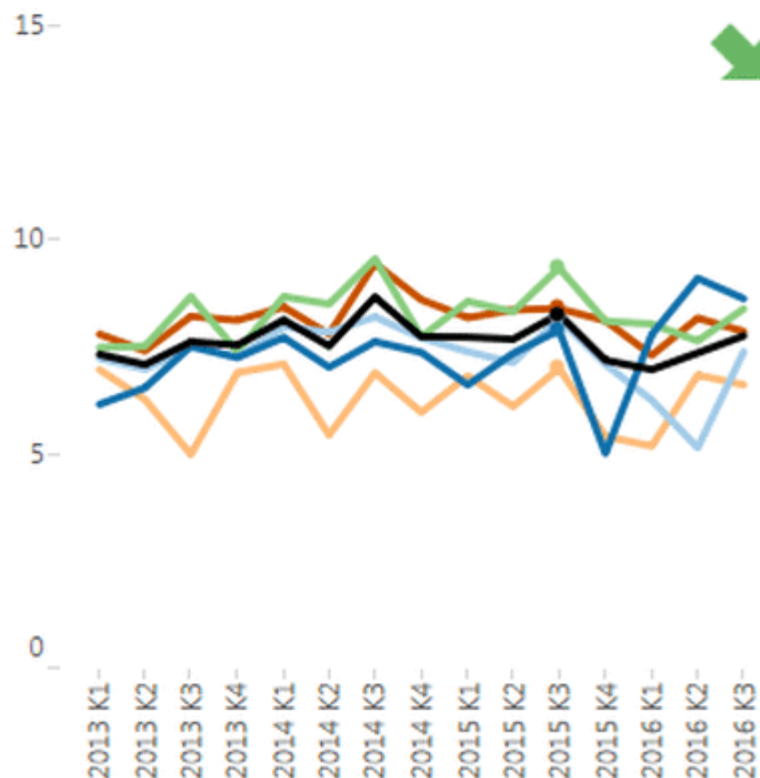
Grøn = ønsket retning

| Region      | Seneste måling | Retning |
|-------------|----------------|---------|
| Midtjylland | 5,8            | ↓       |
| Sjælland    | 6,2            | ↗       |
| Hovedstaden | 7,6            | ↓       |
| Nordjylland | 8,2            | ↗       |
| Syddanmark  | 10,3           | ↗       |
| Hele landet | 7,6            | ↗       |

Danske Regioner (2016). Løbende nøgletal for de nationale mål for sundhedsvæsenet

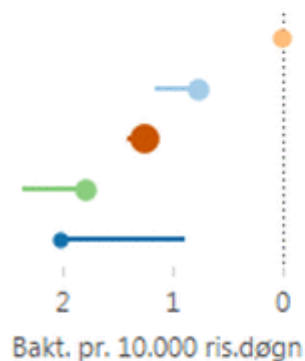
# HAls on the move

Bakteriæmi (bakterier i blodet) pr. 10.000 risikodøgn



Afstand fra bedste

Prikstørrelse udtrykker volumen



Seneste måling

Grøn = ønsket retning

| Region      | Seneste måling | Retning |
|-------------|----------------|---------|
| Sjælland    | 6,6            | ↘       |
| Midtjylland | 7,4            | ↘       |
| Hovedstaden | 7,9            | ↘       |
| Syddanmark  | 8,4            | ↘       |
| Nordjylland | 8,6            | ↗       |
| Hele landet | 7,8            | ↘       |

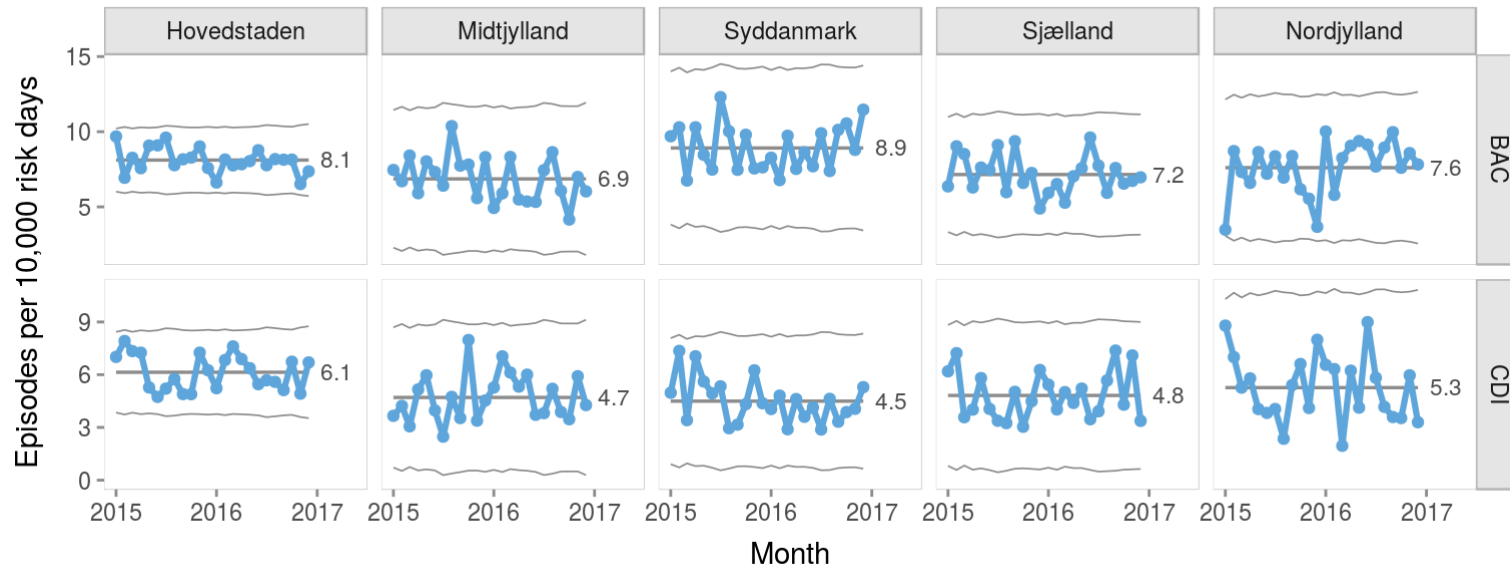
Afstand ml. top og bund ●

Danske Regioner (2016). Løbende nøgletal for de nationale mål for sundhedsvæsenet



# HAIs according to Shewhart

Hospital infections, DK



Source: [www.haiba.dk](http://www.haiba.dk)

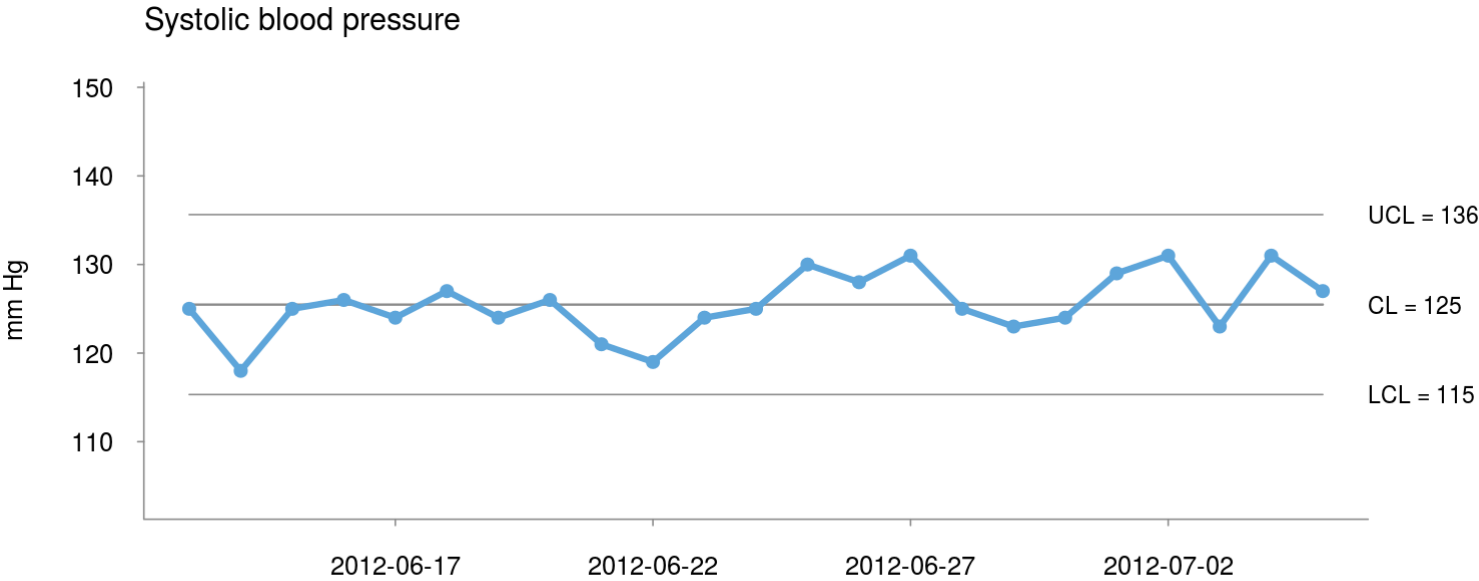
# So, what's the problem?

- Red, amber, green displays speak the voice of the customer.
- Shewhart charts speak the voice of the process.
- No matter how loud you shout, outputs only obey the voice of the process.
- To get what you want you must change the process.
- You cannot change the process by reacting to individual data points.



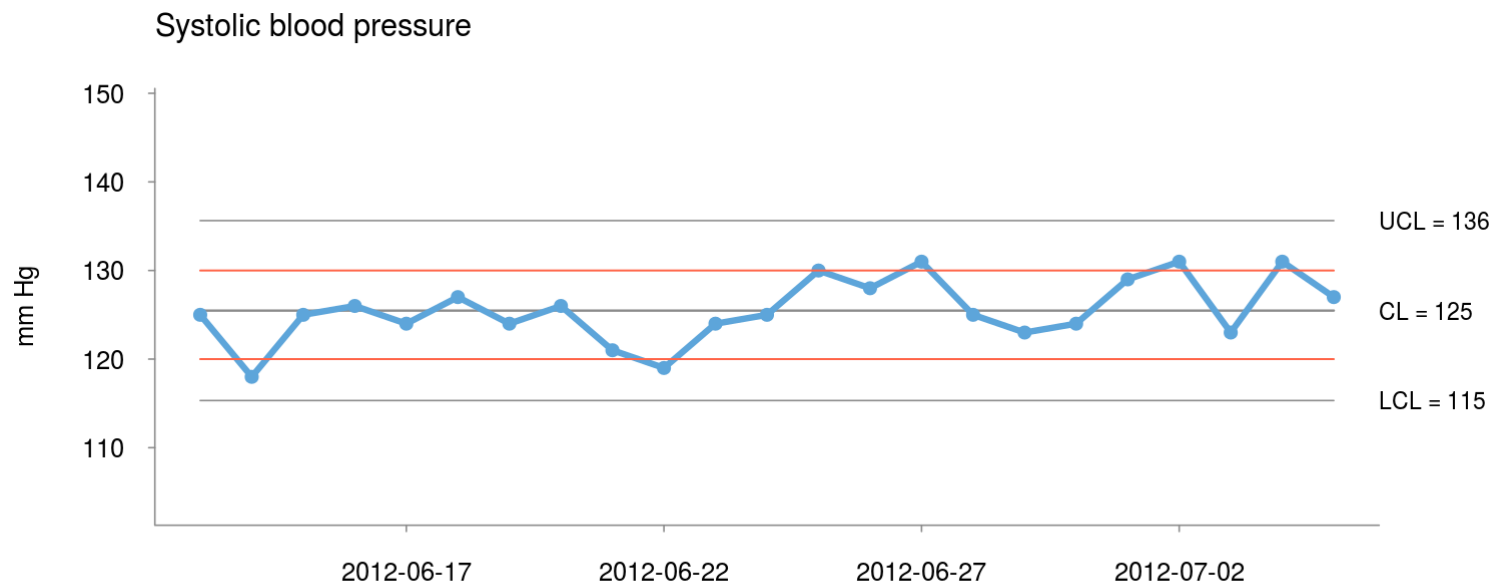
# Process speaking

Hi customer! I'm stable and predictable. Are you satisfied?



# Customer speaking

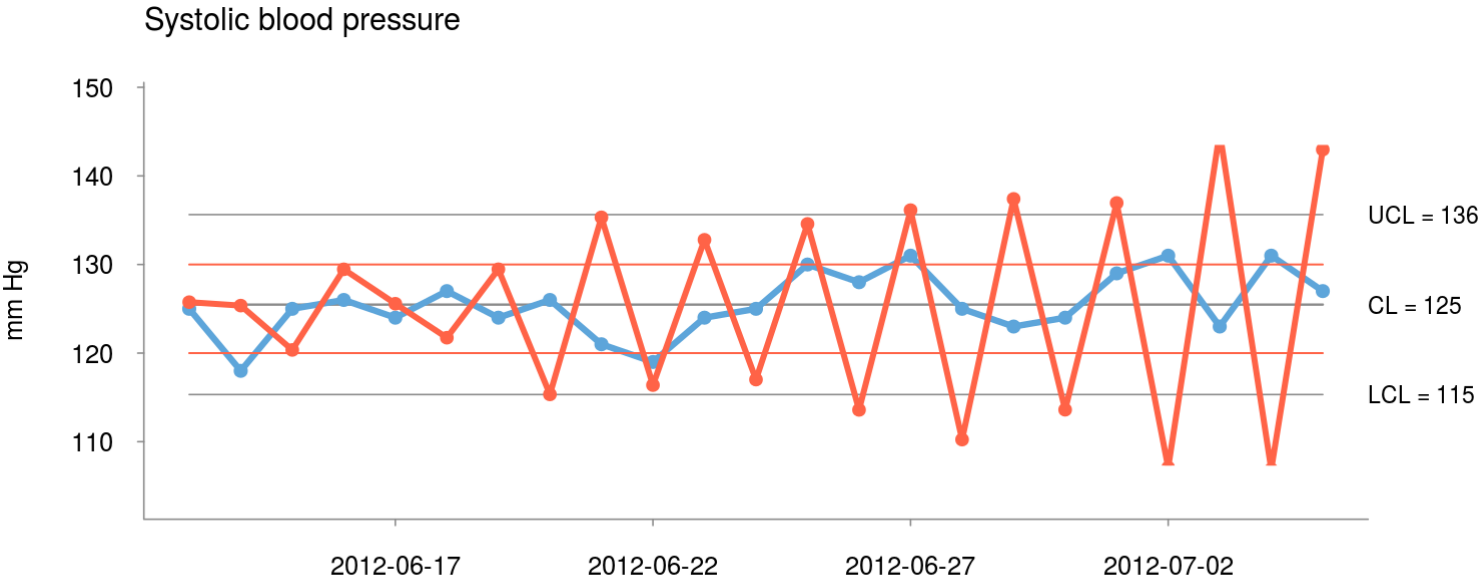
No, silly process! I want less variation.



Let's give more medicine when BP is above average and less when it's below.

# Process replying

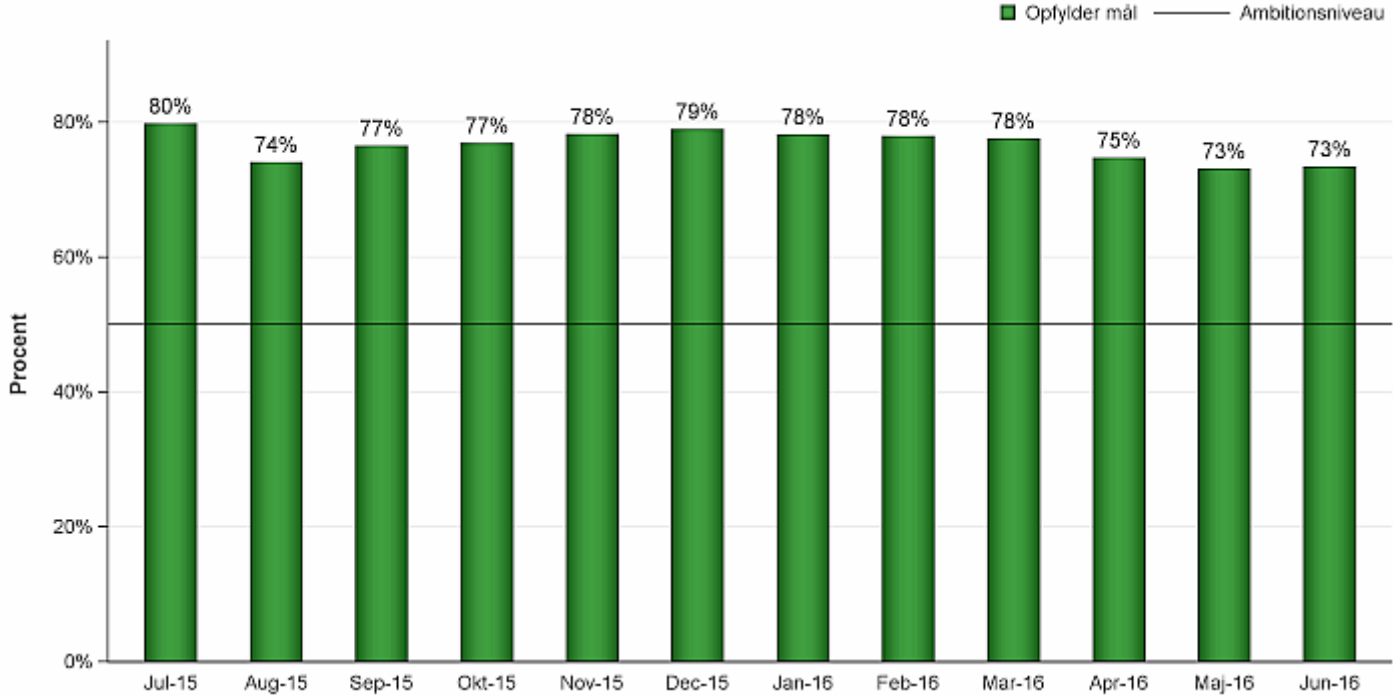
Suit yourself.



But now I'm unstable and unpredictable.

# Customer speaking

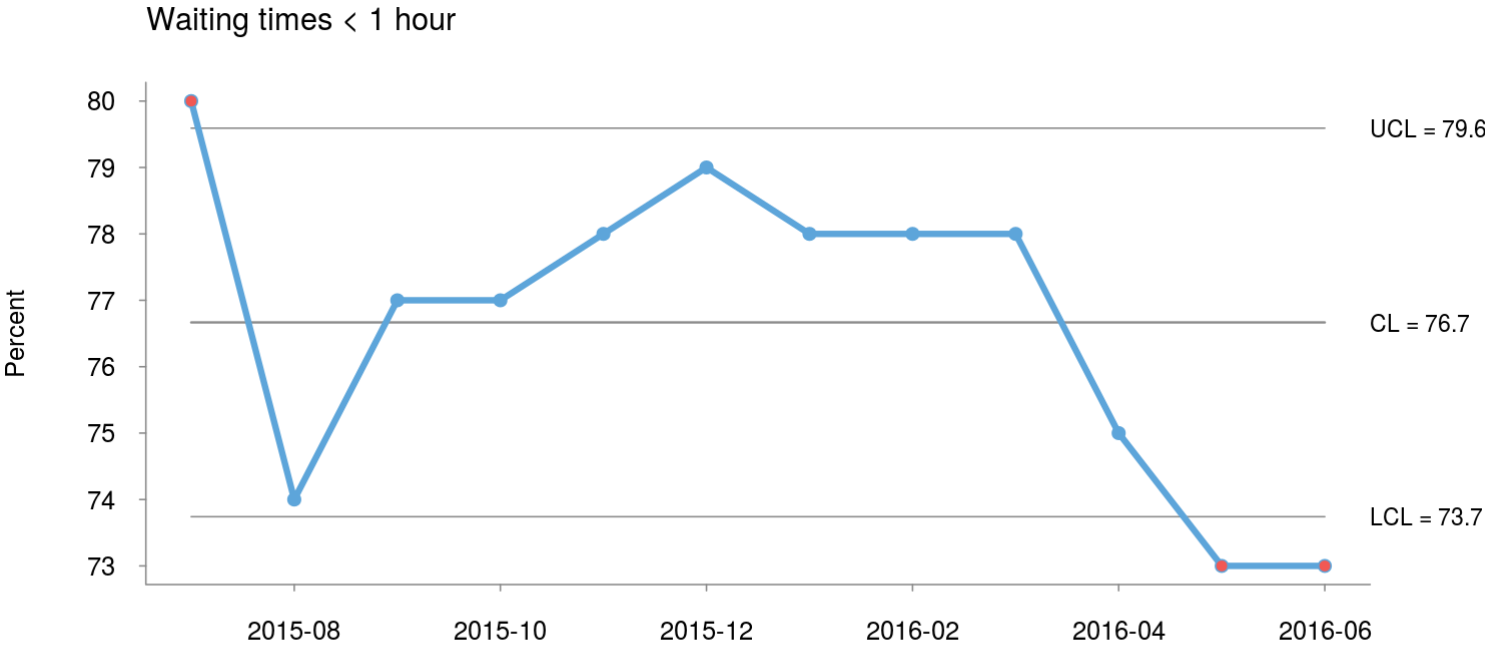
Hello process! You're looking good.



Waiting times < 1 hour. Region Hovedstaden (aug. 2016)

# Process speaking

Thanks customer. But don't rely on me. I'm feeling a bit shaky.



Region Hovedstaden, Driftsmålstyringsrapport august 2016

# A matter of choice

- Red, amber, green displays tell how individual, historical data points compare with numerical targets.
- Shewhart charts tell how the current process performs and what can be expected in the future.

*If your determination to shut your eyes will carry you so far, Cornelius, then we have reached a parting of the ways.*

- Albus Dumbledore to Cornelius Fudge (J K Rowling. Harry Potter and the Goblet of Fire, ch. 36)





# Don Wheeler on Shewhart charts

*Process behavior charts [Shewhart charts] work. They work when nothing else will work. They have been thoroughly proven. They are not on trial. The question is not whether they will work in your area. The only question is whether or not you will, by using these tools and practicing the way of thinking which goes with them, begin to get the most out of your processes and systems.*

*The alternative is to be left behind.*

[Don Wheeler \(2000\). Understanding Variation - the Key to Managing Chaos, 2nd ed., p. 78](#)



# Dilbert on bad assumptions



<http://dilbert.com/strip/2000-03-30>