Assignment Intro HDS - Infant Death Scotland

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Infant mortality in Scotland

##Introduction For this assignment, I wanted to look into the data from the **Scottish Public Health Observatory** regarding changes and distribution in infant mortality in Scotland. "The infant mortality rate is defined as the number of children who die before reaching their first birthday in a given year, expressed per 1 000 live births."[^1]. Ending preventable deaths of newborns and children under the age of five is one of the World Health Organisations sustainable development goals [^2]. My target audience are professionals working for the NHS or councils. The dataset used for this assignment was extracted from the ScotPHO Online Profiles Tool and is freely available for the public.

###Questions With my visualisations I want to answer the following Questions: 1. How did the infant mortality rate in Scotland change between 2004 and 2019? 2. How is the data distributed around the Scottish average, are there outliers? 3. How has the infant mortality rate of the outlying council(s) and their healthboard(s) developed?

##Preparation ###Load packages

```
#loading the packages i used most during the course
library(readr)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(here)
```

```
## here() starts at C:/Users/charl/OneDrive/Documentos/University of Aberdeen/Introduction to Health Da
```

###Read data from ScotPHO The data was downloaded from the Scottish Public Health Observatory **Online Profiles Tool** [^3]. The dataset is called Infant Death, aged 0-1 years. It was last updated in february of 2023. The dataset used for this repot was last downloaded on the 29th of november 2024.

```
#Read in data from ScotPHO

library(readr)
infant_death_all_geo <- read_csv("~/University of Aberdeen/Introduction to Health Data Science/Assignmen
```

###Inspect data The dataset provides values for the years 2004 up to 2019. Geographical areas available are: Council area, Health board, HSC partnership, Scotland. The dataset includes raw numbers as well as the mortality rate with CI's.

```
glimpse(infant_death_all_geo) #to see what data dataset contains
```

```
## Rows: 1,248
## Columns: 11
## $ area_code                 <chr> "S00000001", "S00000001", "S00000001", "S000~
## $ area_type                 <chr> "Scotland", "Scotland", "Scotland", "Scotlan~
## $ area_name                 <chr> "Scotland", "Scotland", "Scotland", "Scotlan~
## $ year                      <dbl> 2004, 2005, 2006, 2007, 2008, 2009, 2010, 20~
## $ period                    <chr> "2002 to 2006 calendar years; 5-year aggrega~
## $ type_definition           <chr> "Crude rate per 1,000 live births", "Crude r~
## $ indicator                 <chr> "Infant deaths, aged 0-1 years", "Infant dea~
## $ numerator                 <dbl> 262.4, 262.6, 260.2, 253.8, 241.2, 240.2, 22~
## $ measure                   <dbl> 4.9, 4.8, 4.6, 4.4, 4.1, 4.1, 3.9, 3.7, 3.6,~
## $ upper_confidence_interval <dbl> 5.5, 5.4, 5.2, 5.0, 4.7, 4.6, 4.4, 4.2, 4.2,~
## $ lower_confidence_interval <dbl> 4.3, 4.2, 4.1, 3.9, 3.6, 3.6, 3.4, 3.2, 3.2,~
```

```
any(is.na(infant_death_all_geo)) #to see if there are missing values
```

```
## [1] FALSE
```

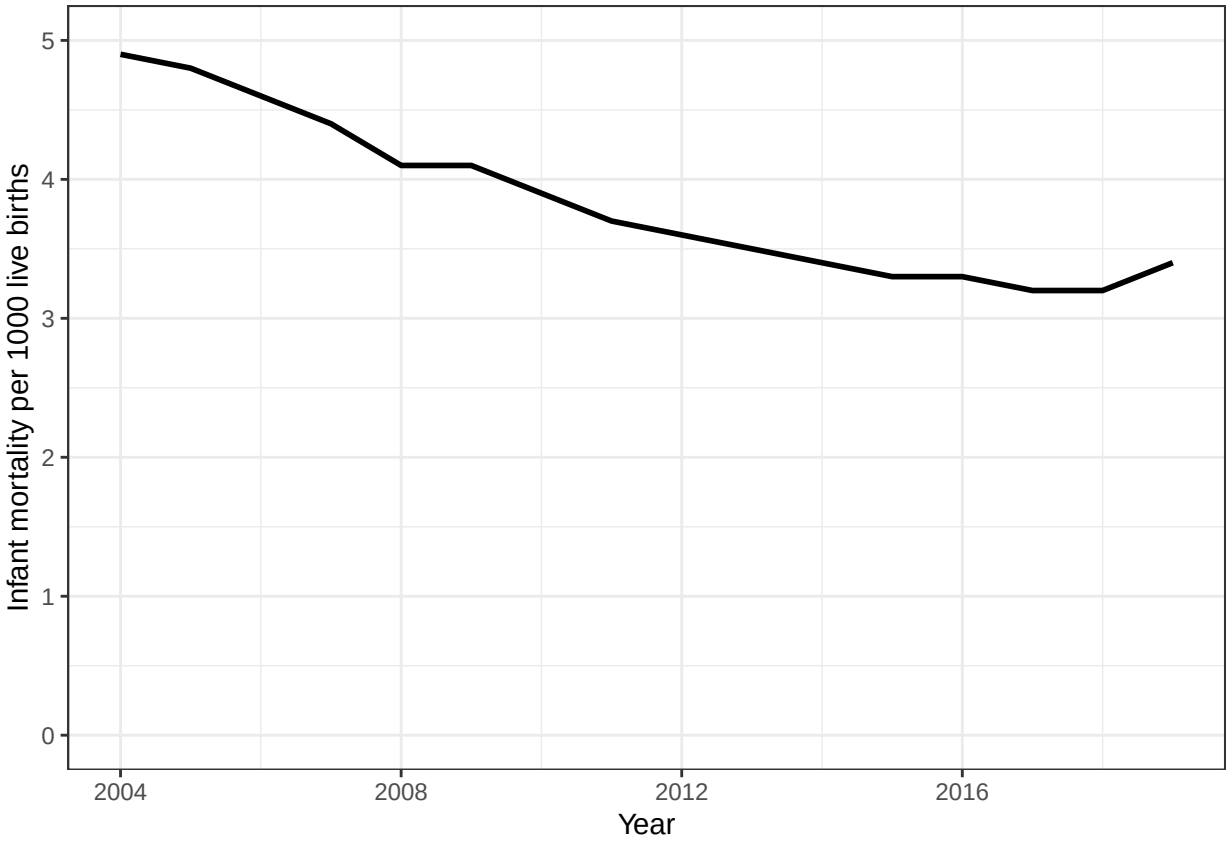
###Data cleaning To be able to compare between areas with different population sizes, i chose to only work with the infant mortality rate ("measure"), not the total numbers ("numerator"). While observing the *mortality_allgeo* dataset, we can observe that every variable has its own column.

```
#Selecting values i need for my visualisations

mortality_allgeo <- infant_death_all_geo %>%
  select(area_code,
         area_type,
         area_name,
         year,
         measure) %>%
  rename(mortality_rate = `measure`)
```

How did the infant mortality rate in Scotland change between 2004 and 2019?

This line graph shows the history of the infant mortality rate in Scotland. Between 2004 and 2018 we can observe a reduction in infant mortality, in 2019 the rate increased slightly .

```r
#visualize graph 1
library(ggplot2)
mortality_allgeo %>%
  select(year, mortality_rate, area_type) %>%
  filter(area_type == "Scotland") %>%
  ggplot() +
  geom_line(aes(x = year, y = mortality_rate), linewidth = 1)+
  labs(x = "Year",
       y = "Infant mortality per 1000 live births") +
  theme_bw()+
   scale_y_continuous(limits = c(0, 5)) #adjusting the scale to include zero -> more realistic visualis
```



How is the data distributed around the Scottish average, are there outliers?

To display the reduction of infant mortality rate within Scotland, I chose to create boxplots using the data from the 33 council areas. ### Prepare data for boxplots

```r
#data for boxplot
mortality_scot_by_council <- mortality_allgeo %>%
  select(`area_type`,
         `area_name`,
         `year`,
         `mortality_rate`) %>%
  filter(`area_type` == "Council area",
```

```
         `year` %in% c("2004", "2007", "2010", "2013", "2016", "2019")) #every 3 years

mortality_scot_by_council$year <- as.factor(mortality_scot_by_council$year) #to help separate boxplots
```

Is the data normally distributed or skewed? Since i wanted to include the SD or IQR I needed to know if the data is normal distributed or skewed. I used the Q-Q-plot and histogram. The histogram showed an outlier to the right, that's why I also used the Q-Q-Plot to make sure. In the *mortality_scot_by_council* dataset we have 192 observations, which approximately allows for 14 bins (square route of 192 = 13.86).

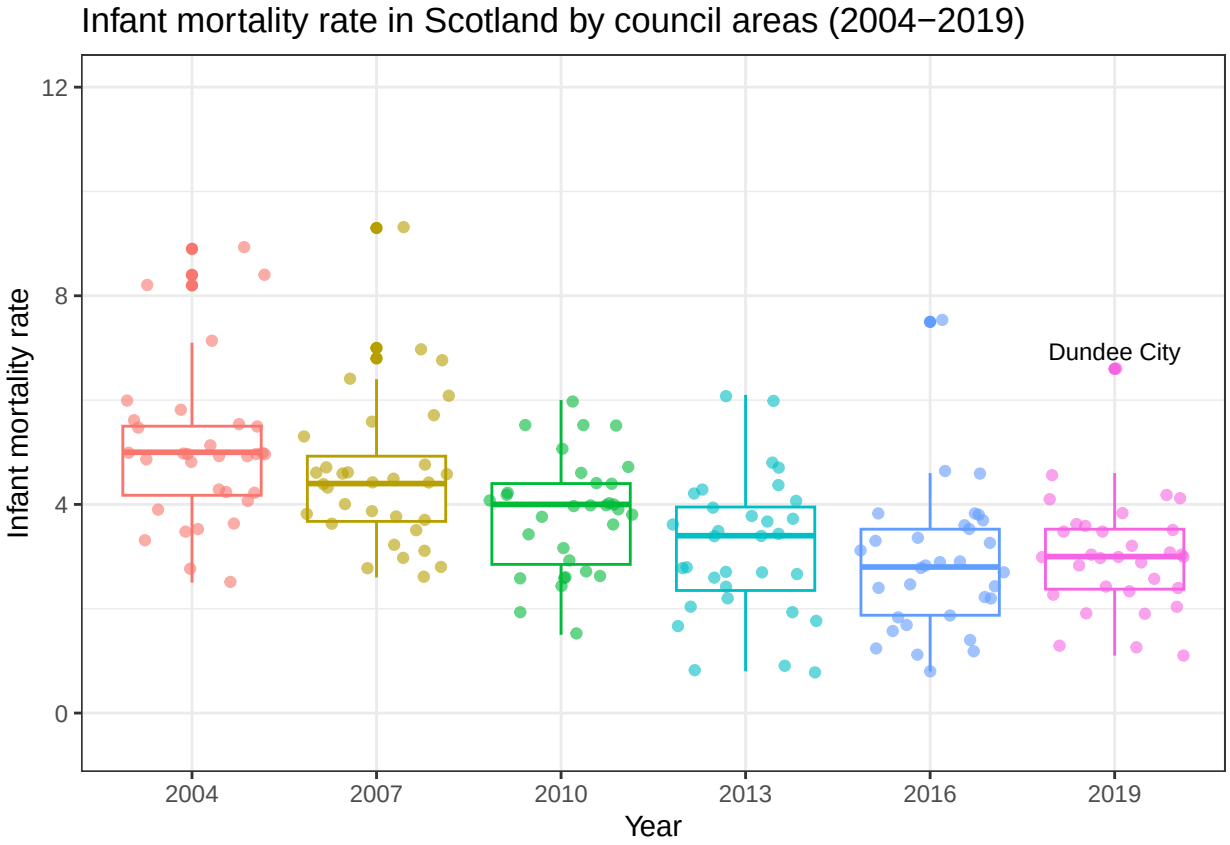
```
#Histogram
mortality_scot_by_council %>%
  ggplot(aes(x = mortality_rate))+
  geom_histogram(bins = 14)

#Q-Q-plot
mortality_scot_by_council %>%
  ggplot(aes(sample = mortality_rate))+
           geom_qq()+
  geom_qq_line()

#data is skewed --> IQR instead of SD (i think, not 100% sure but had to decide)
```

###Preparing additional data for boxplot I created a dataset only including to outliers in 2019 on the higher end since a much lower mortality rate isn't a big problem.

```
# for 2019 upper outliers by name
mortality_out_2019 <- mortality_scot_by_council %>%
  select(area_name, year, mortality_rate) %>%
  filter(year == "2019")

# Q3
Q1 <- quantile(mortality_out_2019$mortality_rate, 0.25)
Q3 <- quantile(mortality_out_2019$mortality_rate, 0.75)
IQR <- Q3 - Q1

# upper whisker
upper_whisker <- Q3 + 1.5 * IQR

#high outliers 2019
up_outliers <- mortality_out_2019 %>%
  filter(mortality_rate > upper_whisker)
```

```
#boxplot
library(ggplot2)

mortality_scot_by_council %>%
  ggplot(aes(x = factor(year),
             y = mortality_rate,
             colour = year)) +
  geom_boxplot() +
  geom_jitter(alpha = 0.6) +
  theme(legend.position = "none")+
```

```
  labs(x = "Year",
       y = "Infant mortality rate",
       title = "Infant mortality rate in Scotland by council areas (2004-2019)")+
  scale_y_continuous(limits = c(-0.5, 12))+
  geom_text(data= up_outliers,aes(x = year, y = mortality_rate, label = area_name),
            color = "black",
            size = 3,
            vjust = -0.5)+
  theme_bw()+
  theme(legend.position = "none")
```



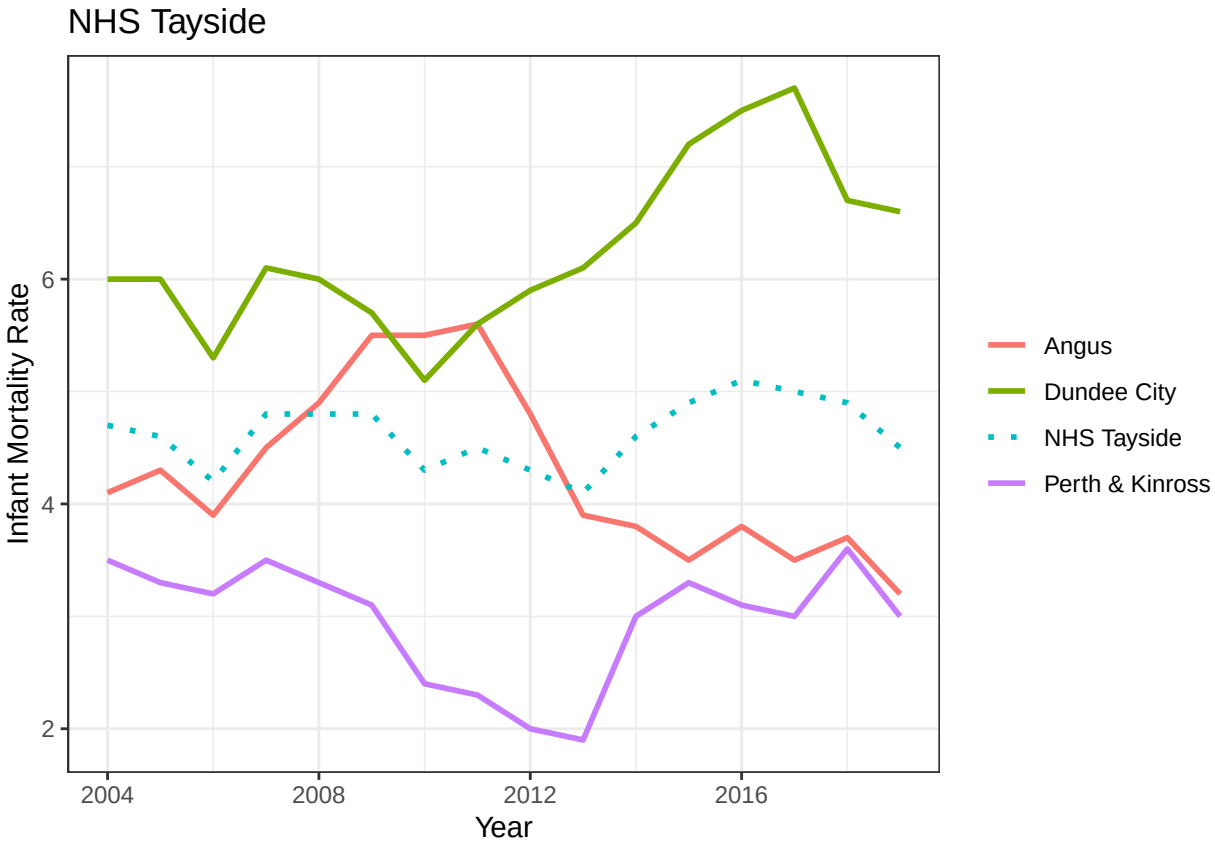
With an infant mortality rate of 6.6 in 2019, **Dundee City** was the only council higher then 1.5 IQR points of the thord quartile.

How has the infant mortality rate of the outlying council(s) and their health-board(s) developed?

The **Dundee City** council forms the **NHS Tayside** together with the councils **Angus** and **Perth & Kinross**.

```
#linegraph for NHS Tayside (dotted) and the councils (solid)

library(ggplot2)
mortality_allgeo %>%
  select(area_name, year, mortality_rate) %>%
```

```r
  filter(area_name %in% c("NHS Tayside", "Dundee City", "Perth & Kinross", "Angus")) %>%
  ggplot()+
  geom_line(aes(x = year, y = mortality_rate, colour = area_name, linetype = area_name), linewidth = 1)+
  scale_linetype_manual(values = c("NHS Tayside" = "dotted",
                                   "Dundee City" = "solid",
                                   "Perth & Kinross" = "solid",
                                   "Angus" = "solid")) +
  labs(x = "Year", y = "Infant Mortality Rate", title = "NHS Tayside")+
  theme_bw()+
   theme(legend.title = element_blank())
```



##References [1] [2]: https://www.who.int/data/gho/data/themes/topics/sdg-target-3_2-newborn-and-child-mortality)