Google Trends Verification Study (Parable of Flu Analysis)

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```r
library(knitr)
opts_chunk$set(tidy.opts=list(width.cutoff=60),tidy=TRUE)
```

Replicating Parable of Google Flu Analysis

Importing Data

```r
library(tidyverse)
setwd('/Users/natan/Desktop/usyd/2022/sem 2/scdl3991/flu paper analysis')
fig10 = read_csv("abdominal pain(Fig S10).csv")
fig15 = read_csv("SFig15.csv")
glimpse(fig10)
```

```
Rows: 121
Columns: 2
$ Month                              <chr> "2004-01", "2004-02", "2004-03", "20~
$ `abdominal pain on my right side` <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, ~
```

```
glimpse(fig15)
```

```
Rows: 510
Columns: 9
$ Week                      <chr> "1/4/2004", "1/11/2004", "1/18/2004", "1/25/2~
$ amoxicillin               <dbl> 40, 31, 30, 29, 21, 26, 26, 29, 33, 32, 29, 3~
$ `early signs of the flu`  <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, ~
$ fever                     <dbl> 45, 46, 49, 52, 48, 47, 51, 48, 47, 45, 52, 5~
$ `influenza a`             <dbl> 17, 10, 9, 9, 9, 9, 9, 0, 0, 0, 0, 0, 0, 0, 0~
$ pnumonia                  <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, ~
$ robitussin                <dbl> 40, 34, 36, 44, 43, 26, 26, 35, 26, 31, 36, 3~
$ `strep throat`            <dbl> 38, 43, 41, 41, 45, 52, 46, 49, 47, 49, 52, 4~
$ `symptoms of bronchitis` <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 42, 0,~
```

Cleaning Data

```
fig10$Month1 = fig10$Month
fig10 <- fig10 |> select(-Month)
fig10 = transform(fig10,month=substr(Month1,6,7),year=substr(Month1,1,4))
fig10 = fig10 |> select(-Month1) |> janitor::clean_names()
fig10$day = 1
fig10$date <- as.Date(paste(fig10$year, fig10$month,fig10$day, sep="-"), "%Y-%m-%d")
fig10 = fig10|> select(abdominal_pain_on_my_right_side, date)



fig15 = fig15  |> mutate(date = as.Date(Week,"%m/%d/%Y")) |> select(-Week)
fig15_long <- gather(fig15, term, value, amoxicillin:`symptoms of bronchitis`, factor_key=TRUE)
```

Replicating Fig.10 Plot

```
library(ggplot2)
fig10 |> ggplot() + aes(x = date, y = abdominal_pain_on_my_right_side) + geom_line() + xlab("Date"
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
conversion failure on 'Fig.10 Searches for "abdominal pain on my right side."'
in 'mbcsToSbcs': dot substituted for <e2>

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```

```
in 'mbcsToSbcs': dot substituted for <9d>
```

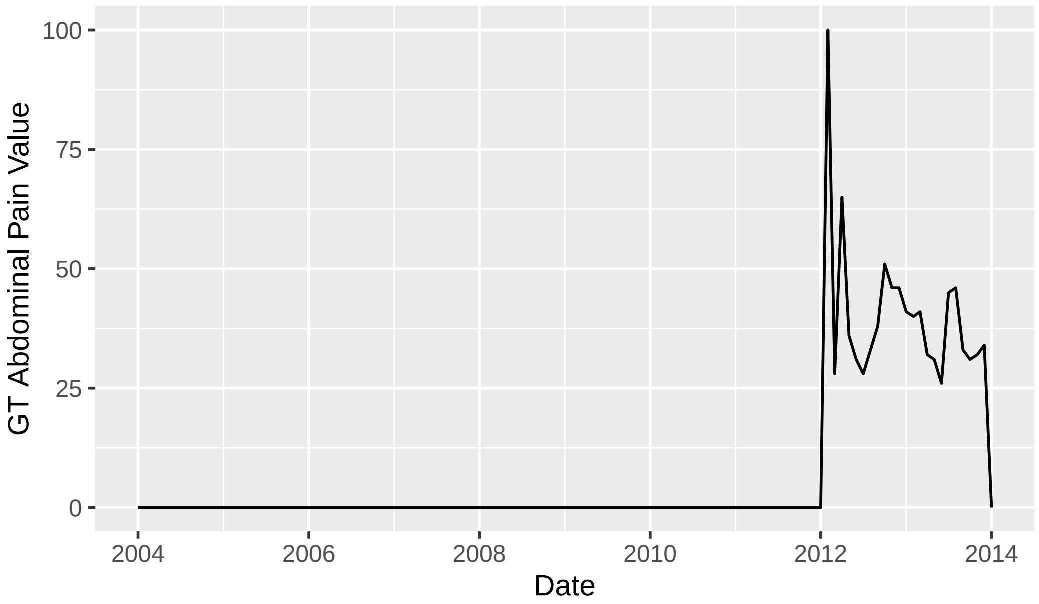
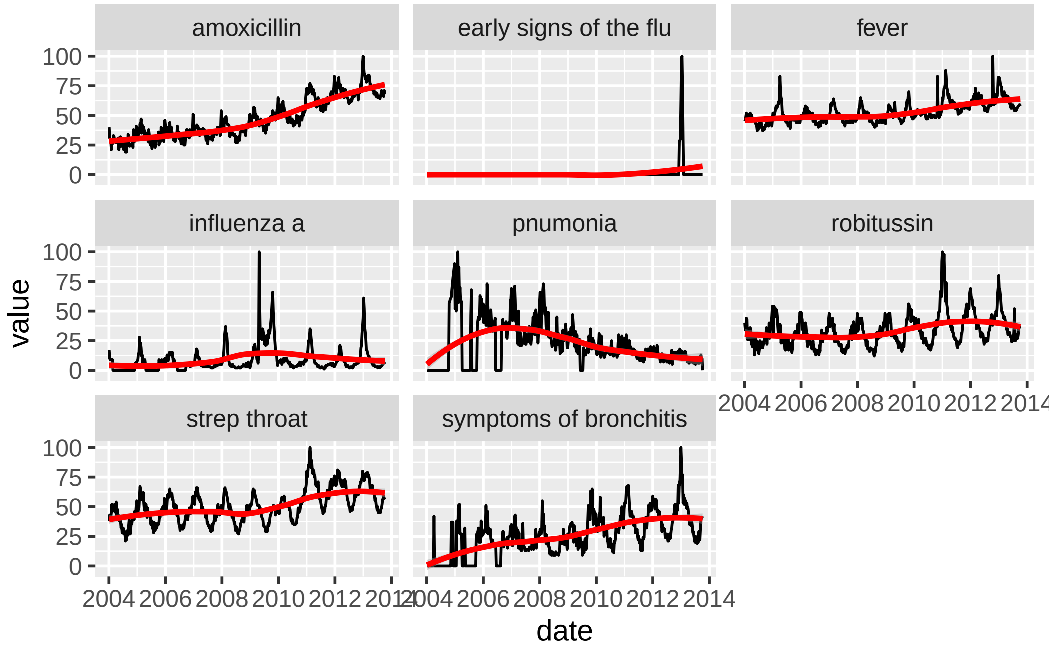


Fig.10 Searches for ...abdominal pain on my right side....

Replicating Fig.15 Plot

```
library(ggplot2)
fig15_long |> ggplot() + aes(x=date,y=value) + geom_line() + geom_smooth(method = "loess", col = '
```

```
`geom_smooth()` using formula 'y ~ x'
```



Replicating Parable of Google Flu Analysis with our Data

Importing Data

```
library(tidyverse)
df_final = read_csv("Parable.csv")
```

```
Rows: 2742265 Columns: 9
-- Column specification --------------------------------------------------------
Delimiter: ","
chr (7): Region, Term, Project, Date, ExtractionDate, StartDate, EndDate
dbl (2): fileno, GT_data_point

i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
glimpse(df_final)
```

```
Rows: 2,742,265
Columns: 9
$ Region         <chr> "US", "US", "US", "US", "US", "US", "US", "US", "US", "~
$ Term           <chr> "abdominal pain on my right side", "abdominal pain on m~
$ Project        <chr> "Parable", "Parable", "Parable", "Parable", "Parable", ~
$ fileno         <dbl> 5169, 5119, 4919, 6028, 3272, 8622, 3836, 4213, 4598, 8~
$ Date           <chr> "01JAN2004", "01JAN2004", "01JAN2004", "01JAN2004", "01~
$ ExtractionDate <chr> "26MAY2021", "27MAY2021", "29MAY2021", "31MAY2021", "01~
$ StartDate      <chr> "01JAN2004", "01JAN2004", "01JAN2004", "01JAN2004", "01~
$ EndDate        <chr> "31JAN2014", "31JAN2014", "31JAN2014", "31JAN2014", "31~
$ GT_data_point  <dbl> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,~
```

Cleaning Data

```
library(janitor)
```

```
Attaching package: 'janitor'
```

```
The following objects are masked from 'package:stats':

    chisq.test, fisher.test
```

```
df_final$date = as.Date(df_final$Date,"%d%b%Y")
df_final$extraction_date = as.Date(df_final$ExtractionDate,"%d%b%Y")
df_final <- df_final |> na.omit(Date) |> na.omit(GT_data_point)|> distinct() |> select(-c('StartDa

# df_final <- df_final |> clean_names() |> arrange(region,term, extraction_date, date) |> group_by
```

Checking Cross Tabulations (Needs to be redone)

```
## How many date obtained for each region and term_topic
df_final_agg <- df_final %>% dplyr::group_by(term, date) %>% dplyr::summarise(n_distinct(extractio

 ## How many gt_values for each date obtained
df_final_agg2 = df_final |> dplyr::group_by(term,extraction_date) |> dplyr::summarise(count=dplyr:

write.csv(df_final_agg,"df_final_agg.csv", row.names = FALSE)
write.csv(df_final_agg2,"df_final_agg2.csv", row.names = FALSE)
```

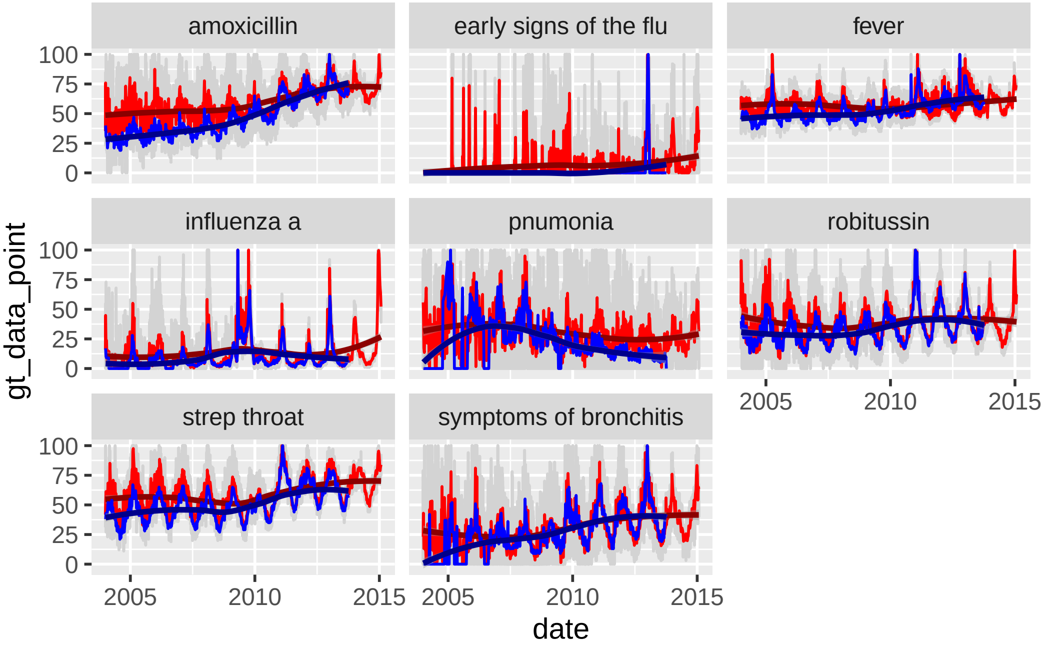
Replicating Fig.10 with our data

```
df_final_fig10 = df_final |> filter(term == 'abdominal pain on my right side') |> select(-c('term'
df_final_fig10_wide = spread(df_final_fig10, extraction_date, gt_data_point)
df_final_fig10_wide$mean = rowMeans(as.matrix(df_final_fig10_wide[,c(2:length(df_final_fig10_wide)
df_final_fig10 = merge(df_final_fig10_wide,fig10,all.y=TRUE)
df_final_fig10$paper_data = df_final_fig10$abdominal_pain_on_my_right_side
df_final_fig10 <- df_final_fig10|> select(-abdominal_pain_on_my_right_side)
df_final_fig10_col <- df_final_fig10|> select(c(date,paper_data,mean))
df_final_fig10_reshaped <- reshape2::melt(df_final_fig10, id.vars="date")
df_final_fig10_reshaped_col <- reshape2::melt(df_final_fig10_col, id.vars="date")


p1 = ggplot(df_final_fig10_reshaped) +
  geom_line(aes(x=date,y=value),color = "lightgrey")

p1 = p1 + geom_line(data =df_final_fig10_reshaped_col,aes(x=date,y=value, col = variable),size=0.8
```

Replicating Fig.15 Plot with our data

```
library(ggplot2)
df_final_fig15 = df_final |> filter(term !='abdominal pain on my right side') |> filter(term !='fl
p5 = df_final_fig15 |> ggplot() + aes(x = date,y=gt_data_point) + geom_line(col = 'lightgrey') + f
df_final_fig15_means = df_final_fig15 |> group_by(date,term) |> mutate(mean = mean(gt_data_point))
p5 = p5 + geom_line(data =df_final_fig15_means, aes(x=date,y=mean), col = 'red')
p5 = p5 + geom_smooth(data =df_final_fig15_means, aes(x=date,y=mean),method = "loess", col = 'dark
p5 = p5  + geom_line( data =fig15_long ,aes(x=date,y=value), col = 'blue')
p5 = p5+ geom_smooth(data =fig15_long, aes(x=date,y=value),method = "loess", col = 'darkblue')
p5
```

```
`geom_smooth()` using formula 'y ~ x'
`geom_smooth()` using formula 'y ~ x'
```


amoxicillin
early signs of the flu
fever
influenza a
pnumonia
robitussin
strep throat
symptoms of bronchitis
gt_data_point
date