Run 4 Course 1 Week 2 Office Hour

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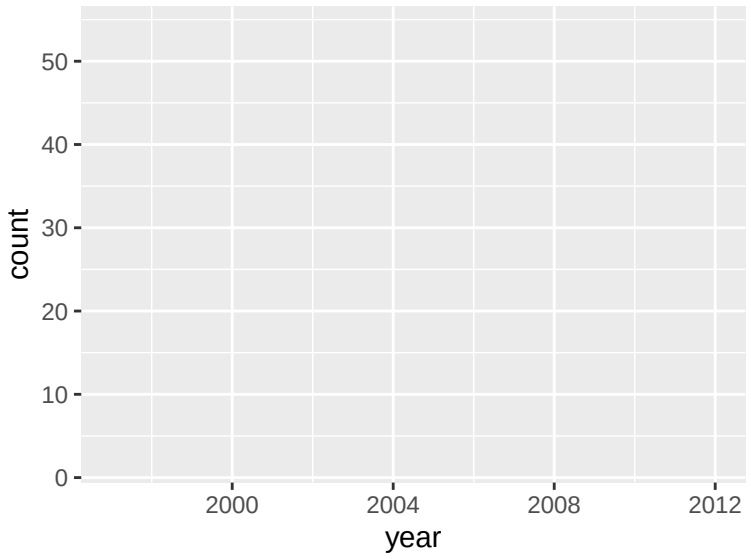
```
library(tidyverse)
```

```
# load data and filter the aus without missing value in age group
tb <- read_rds(here::here("data", "tb_tidy.rds"))
tb_au <- filter(tb, country == "Australia", !is.na(age_group))
tb_au
```

```
## # A tibble: 192 x 6
##    country   iso3   year count sex   age_group
##    <chr>     <chr> <dbl> <dbl> <fct> <fct>
##  1 Australia AUS    1997     8 M     15-24
##  2 Australia AUS    1998    11 M     15-24
##  3 Australia AUS    1999    13 M     15-24
##  4 Australia AUS    2000    16 M     15-24
##  5 Australia AUS    2001    23 M     15-24
##  6 Australia AUS    2002    15 M     15-24
##  7 Australia AUS    2003    14 M     15-24
##  8 Australia AUS    2004    18 M     15-24
##  9 Australia AUS    2005    32 M     15-24
## 10 Australia AUS    2006    33 M     15-24
## # ... with 182 more rows
```

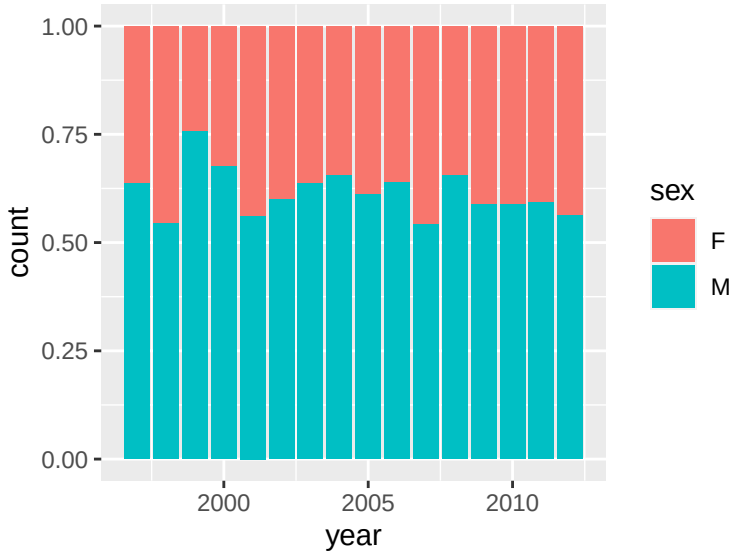
```
# blank plot
p1 <- ggplot(tb_au, aes(x = year, y = count, fill = sex))
p1
```



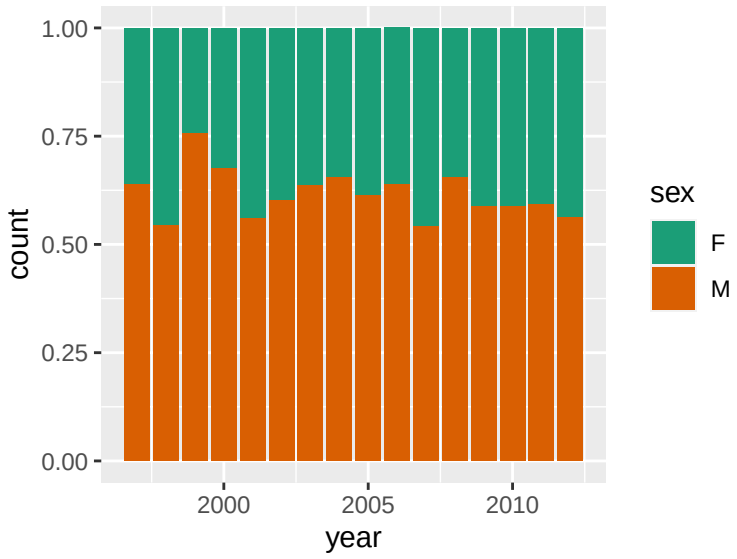
Bar chart

100% Bar Chart

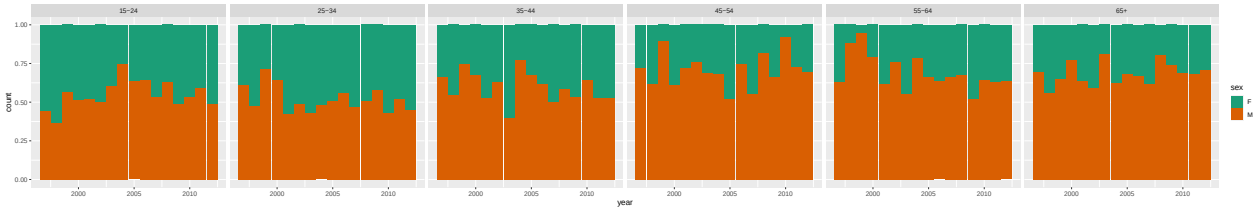
```
# 100% bar chart
p2 <- p1 + geom_bar(stat = "identity", position = "fill")
p2
```




```
# change color which friendly for colour blindness
p3 <- p2 + scale_fill_brewer(palette = "Dark2")
p3
```

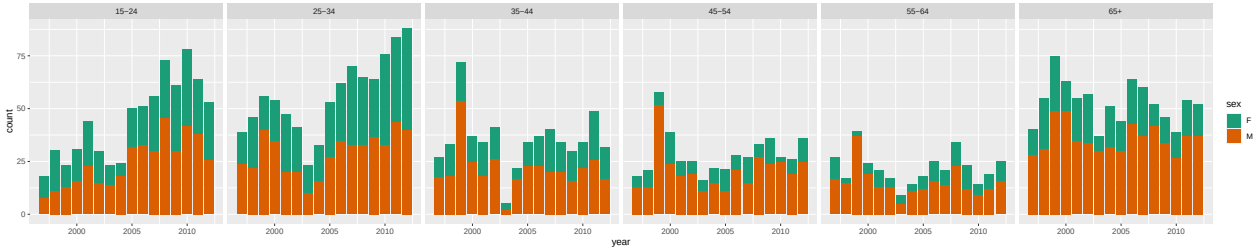



```
p4 <- p3 + facet_grid(.~age_group)
p4
```



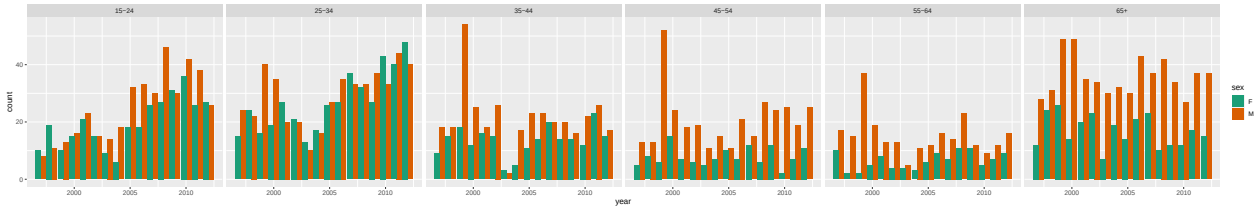
Stack bar chart

```
stack_bar <- ggplot(tb_au, aes(x = year, y = count, fill = sex)) +
  geom_bar(stat = "identity", position = "stack") +
  facet_grid(~ age_group) +
  scale_fill_brewer(palette="Dark2")

stack_bar
```



Side by side bar chart (dodge)

```
sbs_bar <- ggplot(tb_au, aes(x = year, y = count, fill = sex)) +
  geom_bar(stat = "identity", position = "dodge") +
  facet_grid(~ age_group) +
  scale_fill_brewer(palette="Dark2")

sbs_bar
```



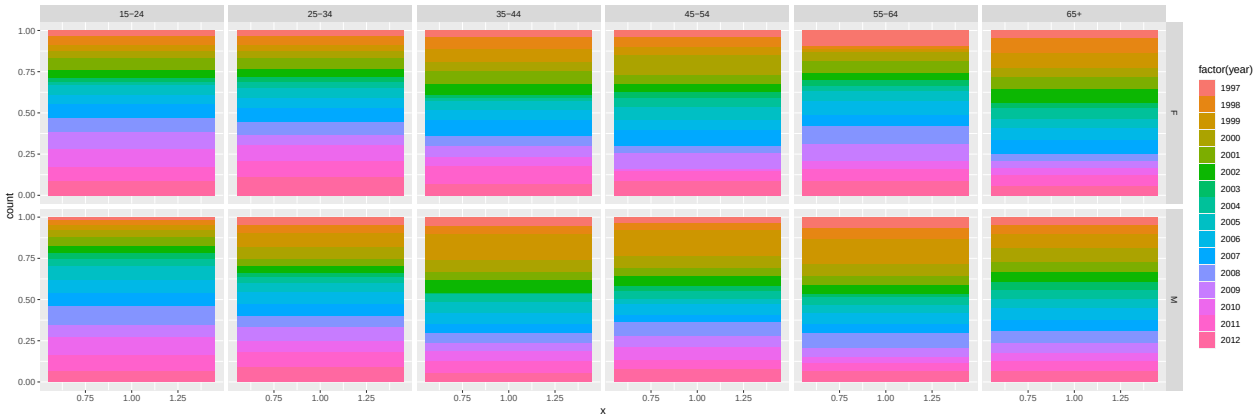
Separated bar chart

```
sep_bar <- ggplot(tb_au, aes(x = year, y = count, fill = sex)) +
  geom_bar(stat = "identity") +
  facet_grid(sex ~ age_group) +
  scale_fill_brewer(palette="Dark2")

sep_bar
```

Rainbow, rose and pie charts

Rainbow chart

```
rainbow <- ggplot(tb_au, aes(x = 1, y = count, fill = factor(year))) +
  geom_bar(stat = "identity", position="fill") +
  facet_grid(sex ~ age_group)

rainbow
```

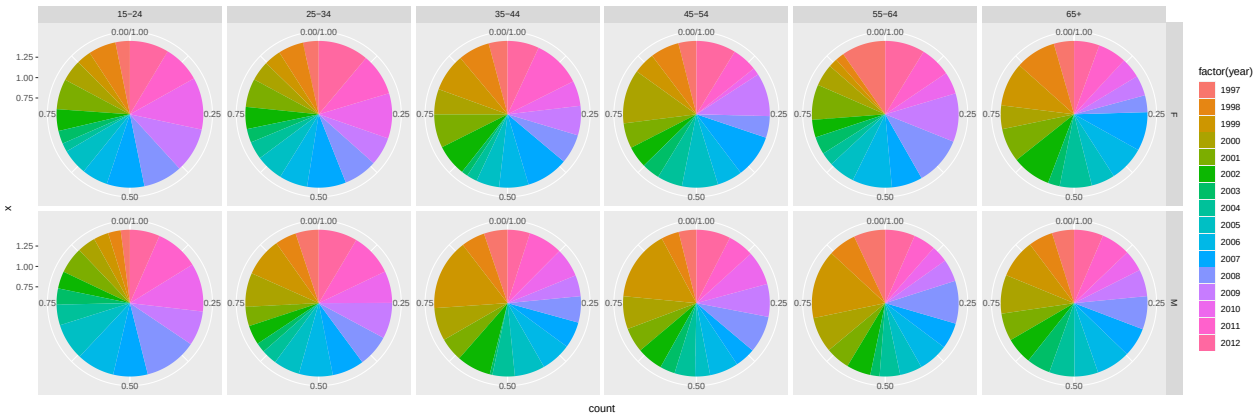


Rose chart

```
rose <- ggplot(tb_au, aes(x = year, y = count, fill = sex)) +
  geom_bar(stat = "identity") +
  facet_grid(sex ~ age_group) +
  scale_fill_brewer(palette="Dark2") +
  # change to rose chart
  coord_polar()
rose
```

Rainbow pie chart

```
rainbow_pie <- rainbow +
  # change to pie chart
  coord_polar(theta = "y")

rainbow_pie
```



Tidy data

What is tidy data?

- Each variable is in a column.
- Each observation is a row.
- Each value is a cell.

gather function

```
tb_smaller <- tibble(year = c(2016, 2017, 2018),
                     male = c(10, 20, 30),
                     female = c(5, 15, 12))
tb_smaller
```

```
## # A tibble: 3 x 3
##    year  male female
##   <dbl> <dbl>  <dbl>
## 1  2016    10      5
## 2  2017    20     15
## 3  2018    30     12
```

```
tb_smaller_long <- gather(tb_smaller,
                          # key is the value in the column names
                          key = "sex",
                          # value is the value in the cell
                          value = "count",
                          # the variable take into account in the tb_smaller data
                          male, female)
tb_smaller_long
```

```
## # A tibble: 6 x 3
##    year sex    count
##   <dbl> <chr>  <dbl>
## 1  2016 male      10
```

```
## 2  2017 male      20
## 3  2018 male      30
## 4  2016 female     5
## 5  2017 female    15
## 6  2018 female    12
```

tidy format

```
tb
```

```
## # A tibble: 47,866 x 6
##    country     iso3   year count sex   age_group
##    <chr>       <chr> <dbl> <dbl> <fct> <fct>
##  1 Afghanistan AFG    1997    10 M     15-24
##  2 Afghanistan AFG    1998   129 M     15-24
##  3 Afghanistan AFG    1999    55 M     15-24
##  4 Afghanistan AFG    2000   228 M     15-24
##  5 Afghanistan AFG    2001   379 M     15-24
##  6 Afghanistan AFG    2002   476 M     15-24
##  7 Afghanistan AFG    2003   511 M     15-24
##  8 Afghanistan AFG    2004   537 M     15-24
##  9 Afghanistan AFG    2005   606 M     15-24
## 10 Afghanistan AFG    2006   837 M     15-24
## # ... with 47,856 more rows
```

messey format

```
tb_messy <- read_csv("data/TB_notifications.csv")
tb_messy
```

```
## # A tibble: 7,891 x 23
##    country iso3   year new_sp_m04 new_sp_m514 new_sp_m014 new_sp_m1524
##    <chr>   <chr> <dbl>      <dbl>       <dbl>       <dbl>        <dbl>
##  1 Afghan~ AFG    1980         NA          NA          NA           NA
##  2 Afghan~ AFG    1981         NA          NA          NA           NA
##  3 Afghan~ AFG    1982         NA          NA          NA           NA
##  4 Afghan~ AFG    1983         NA          NA          NA           NA
##  5 Afghan~ AFG    1984         NA          NA          NA           NA
##  6 Afghan~ AFG    1985         NA          NA          NA           NA
##  7 Afghan~ AFG    1986         NA          NA          NA           NA
##  8 Afghan~ AFG    1987         NA          NA          NA           NA
##  9 Afghan~ AFG    1988         NA          NA          NA           NA
## 10 Afghan~ AFG    1989         NA          NA          NA           NA
## # ... with 7,881 more rows, and 16 more variables: new_sp_m2534 <dbl>,
## #   new_sp_m3544 <dbl>, new_sp_m4554 <dbl>, new_sp_m5564 <dbl>,
## #   new_sp_m65 <dbl>, new_sp_mu <dbl>, new_sp_f04 <dbl>, new_sp_f514 <dbl>,
## #   new_sp_f014 <dbl>, new_sp_f1524 <dbl>, new_sp_f2534 <dbl>,
## #   new_sp_f3544 <dbl>, new_sp_f4554 <dbl>, new_sp_f5564 <dbl>,
## #   new_sp_f65 <dbl>, new_sp_fu <dbl>
```

Convert data in from wide format to long format

```
tb_long <- gather(tb_messy, key = "sex_agegroup", value = "count", -country, -year, -iso3)
tb_long
```

```
## # A tibble: 157,820 x 5
##    country     iso3   year sex_agegroup count
##    <chr>       <chr> <dbl> <chr>        <dbl>
##  1 Afghanistan AFG    1980 new_sp_m04      NA
##  2 Afghanistan AFG    1981 new_sp_m04      NA
##  3 Afghanistan AFG    1982 new_sp_m04      NA
##  4 Afghanistan AFG    1983 new_sp_m04      NA
##  5 Afghanistan AFG    1984 new_sp_m04      NA
##  6 Afghanistan AFG    1985 new_sp_m04      NA
##  7 Afghanistan AFG    1986 new_sp_m04      NA
##  8 Afghanistan AFG    1987 new_sp_m04      NA
##  9 Afghanistan AFG    1988 new_sp_m04      NA
## 10 Afghanistan AFG    1989 new_sp_m04      NA
## # ... with 157,810 more rows
```

Convert data in from long format to wide format

```
tb_wide <- spread(tb_long, key = "sex_agegroup", value = "count")
tb_wide
```

```
## # A tibble: 7,891 x 23
##    country iso3   year new_sp_f014 new_sp_f04 new_sp_f1524 new_sp_f2534
##    <chr>   <chr> <dbl>       <dbl>      <dbl>        <dbl>        <dbl>
##  1 Afghan~ AFG    1980          NA         NA           NA           NA
##  2 Afghan~ AFG    1981          NA         NA           NA           NA
##  3 Afghan~ AFG    1982          NA         NA           NA           NA
##  4 Afghan~ AFG    1983          NA         NA           NA           NA
##  5 Afghan~ AFG    1984          NA         NA           NA           NA
##  6 Afghan~ AFG    1985          NA         NA           NA           NA
##  7 Afghan~ AFG    1986          NA         NA           NA           NA
##  8 Afghan~ AFG    1987          NA         NA           NA           NA
##  9 Afghan~ AFG    1988          NA         NA           NA           NA
## 10 Afghan~ AFG    1989          NA         NA           NA           NA
## # ... with 7,881 more rows, and 16 more variables: new_sp_f3544 <dbl>,
## #   new_sp_f4554 <dbl>, new_sp_f514 <dbl>, new_sp_f5564 <dbl>,
## #   new_sp_f65 <dbl>, new_sp_fu <dbl>, new_sp_m014 <dbl>, new_sp_m04 <dbl>,
## #   new_sp_m1524 <dbl>, new_sp_m2534 <dbl>, new_sp_m3544 <dbl>,
## #   new_sp_m4554 <dbl>, new_sp_m514 <dbl>, new_sp_m5564 <dbl>,
## #   new_sp_m65 <dbl>, new_sp_mu <dbl>
```

Separate "sex_agegroup"

```
tb_long2 <- separate(tb_long,
                     col = "sex_agegroup",
                     into = c("type", "sex_agegroup"),
                     # split at the underscore that is followed by the characters "m" or "f"
                     sep = "_(?=[mf])"
)
tb_long2
```

```
## # A tibble: 157,820 x 6
##    country     iso3   year type   sex_agegroup count
##    <chr>       <chr> <dbl> <chr>  <chr>        <dbl>
##  1 Afghanistan AFG    1980 new_sp m04             NA
##  2 Afghanistan AFG    1981 new_sp m04             NA
##  3 Afghanistan AFG    1982 new_sp m04             NA
##  4 Afghanistan AFG    1983 new_sp m04             NA
##  5 Afghanistan AFG    1984 new_sp m04             NA
##  6 Afghanistan AFG    1985 new_sp m04             NA
##  7 Afghanistan AFG    1986 new_sp m04             NA
##  8 Afghanistan AFG    1987 new_sp m04             NA
##  9 Afghanistan AFG    1988 new_sp m04             NA
## 10 Afghanistan AFG    1989 new_sp m04             NA
## # ... with 157,810 more rows
```

Extract the "age_group"

```
tb_long3 <- extract(tb_long2,
                    col = "sex_agegroup",
                    into = c("sex", "age_group"),
                    # the first says match characters "m" or "f"
                    # the second says match anything that comes after.
                    regex = "([mf])(.*)")
tb_long3
```

```
## # A tibble: 157,820 x 7
##    country     iso3   year type   sex   age_group count
##    <chr>       <chr> <dbl> <chr>  <chr> <chr>     <dbl>
##  1 Afghanistan AFG    1980 new_sp m     04           NA
##  2 Afghanistan AFG    1981 new_sp m     04           NA
##  3 Afghanistan AFG    1982 new_sp m     04           NA
##  4 Afghanistan AFG    1983 new_sp m     04           NA
##  5 Afghanistan AFG    1984 new_sp m     04           NA
##  6 Afghanistan AFG    1985 new_sp m     04           NA
##  7 Afghanistan AFG    1986 new_sp m     04           NA
##  8 Afghanistan AFG    1987 new_sp m     04           NA
##  9 Afghanistan AFG    1988 new_sp m     04           NA
## 10 Afghanistan AFG    1989 new_sp m     04           NA
## # ... with 157,810 more rows
```

Wrangling data

wrangling verbs:

- filter (To pick cases/rows)
- select (Select columns, and ignores all others)
- mutate (Add columns)
- summarise (Calculate a summary)
- group_by (Group data)
- arrange (Sort rows)

Filter data

```
tb_long
```

```
## # A tibble: 157,820 x 5
##    country     iso3   year sex_agegroup count
##    <chr>       <chr> <dbl> <chr>        <dbl>
##  1 Afghanistan AFG    1980 new_sp_m04      NA
##  2 Afghanistan AFG    1981 new_sp_m04      NA
##  3 Afghanistan AFG    1982 new_sp_m04      NA
##  4 Afghanistan AFG    1983 new_sp_m04      NA
##  5 Afghanistan AFG    1984 new_sp_m04      NA
##  6 Afghanistan AFG    1985 new_sp_m04      NA
##  7 Afghanistan AFG    1986 new_sp_m04      NA
##  8 Afghanistan AFG    1987 new_sp_m04      NA
##  9 Afghanistan AFG    1988 new_sp_m04      NA
## 10 Afghanistan AFG    1989 new_sp_m04      NA
## # ... with 157,810 more rows
```

```
# filter country equal to Australia
tb_au <- filter(tb_long, country == "Australia")
tb_au
```

```
## # A tibble: 740 x 5
##    country   iso3   year sex_agegroup count
##    <chr>     <chr> <dbl> <chr>        <dbl>
##  1 Australia AUS    1980 new_sp_m04      NA
##  2 Australia AUS    1981 new_sp_m04      NA
##  3 Australia AUS    1982 new_sp_m04      NA
##  4 Australia AUS    1983 new_sp_m04      NA
##  5 Australia AUS    1984 new_sp_m04      NA
##  6 Australia AUS    1985 new_sp_m04      NA
##  7 Australia AUS    1986 new_sp_m04      NA
##  8 Australia AUS    1987 new_sp_m04      NA
##  9 Australia AUS    1988 new_sp_m04      NA
## 10 Australia AUS    1989 new_sp_m04      NA
## # ... with 730 more rows
```

```
# filter count larger than 10
filter(tb_long, count >= 10)
```

```
## # A tibble: 31,507 x 5
##    country   iso3   year sex_agegroup count
##    <chr>     <chr> <dbl> <chr>        <dbl>
##  1 Angola    AGO    2011 new_sp_m04     108
##  2 Angola    AGO    2012 new_sp_m04      58
##  3 Argentina ARG    2006 new_sp_m04      19
##  4 Argentina ARG    2007 new_sp_m04      14
##  5 Argentina ARG    2008 new_sp_m04      11
##  6 Argentina ARG    2010 new_sp_m04      13
##  7 Argentina ARG    2011 new_sp_m04      50
##  8 Botswana  BWA    2009 new_sp_m04      12
##  9 Botswana  BWA    2010 new_sp_m04      11
## 10 Botswana  BWA    2011 new_sp_m04      14
## # ... with 31,497 more rows
```

```
filter(tb_long, iso3 %in% c("AUS", "NZL", "IDN"))
```

```
## # A tibble: 2,220 x 5
##    country   iso3   year sex_agegroup count
##    <chr>     <chr> <dbl> <chr>        <dbl>
##  1 Australia AUS    1980 new_sp_m04      NA
##  2 Australia AUS    1981 new_sp_m04      NA
##  3 Australia AUS    1982 new_sp_m04      NA
##  4 Australia AUS    1983 new_sp_m04      NA
##  5 Australia AUS    1984 new_sp_m04      NA
##  6 Australia AUS    1985 new_sp_m04      NA
##  7 Australia AUS    1986 new_sp_m04      NA
##  8 Australia AUS    1987 new_sp_m04      NA
##  9 Australia AUS    1988 new_sp_m04      NA
## 10 Australia AUS    1989 new_sp_m04      NA
## # ... with 2,210 more rows
```

```
filter(tb_long, !is.na(count))
```

```
## # A tibble: 50,974 x 5
##    country     iso3   year sex_agegroup count
##    <chr>       <chr> <dbl> <chr>        <dbl>
##  1 Afghanistan AFG    2010 new_sp_m04       4
##  2 Afghanistan AFG    2011 new_sp_m04       2
##  3 Afghanistan AFG    2012 new_sp_m04       0
##  4 Albania     ALB    2005 new_sp_m04       0
##  5 Albania     ALB    2006 new_sp_m04       1
##  6 Albania     ALB    2007 new_sp_m04       0
##  7 Albania     ALB    2008 new_sp_m04       1
##  8 Albania     ALB    2009 new_sp_m04       0
##  9 Albania     ALB    2010 new_sp_m04       0
## 10 Albania     ALB    2011 new_sp_m04       0
## # ... with 50,964 more rows
```

```
# filter base on two condition
filter(tb_long, !is.na(count) & country == "India")
```

```
## # A tibble: 252 x 5
##    country iso3   year sex_agegroup count
##    <chr>   <chr> <dbl> <chr>        <dbl>
##  1 India   IND    1995 new_sp_m014     16
##  2 India   IND    1996 new_sp_m014     47
##  3 India   IND    1997 new_sp_m014     50
##  4 India   IND    1998 new_sp_m014     84
##  5 India   IND    1999 new_sp_m014    327
##  6 India   IND    2000 new_sp_m014   1588
##  7 India   IND    2001 new_sp_m014   1063
##  8 India   IND    2002 new_sp_m014   2551
##  9 India   IND    2003 new_sp_m014   2411
## 10 India   IND    2004 new_sp_m014   3018
## # ... with 242 more rows
```

```
# Another way to filter base on two condition
filter(tb_long, !is.na(count), country == "India")
```

```
## # A tibble: 252 x 5
##    country iso3   year sex_agegroup count
##    <chr>   <chr> <dbl> <chr>        <dbl>
##  1 India   IND    1995 new_sp_m014     16
##  2 India   IND    1996 new_sp_m014     47
##  3 India   IND    1997 new_sp_m014     50
##  4 India   IND    1998 new_sp_m014     84
##  5 India   IND    1999 new_sp_m014    327
##  6 India   IND    2000 new_sp_m014   1588
##  7 India   IND    2001 new_sp_m014   1063
##  8 India   IND    2002 new_sp_m014   2551
##  9 India   IND    2003 new_sp_m014   2411
## 10 India   IND    2004 new_sp_m014   3018
## # ... with 242 more rows
```

```
# fiter union of data not missing in count or country equal to India
filter(tb_long, !is.na(count) | country == "India")
```

```
## # A tibble: 51,462 x 5
##    country     iso3   year sex_agegroup count
##    <chr>       <chr> <dbl> <chr>        <dbl>
##  1 Afghanistan AFG    2010 new_sp_m04       4
##  2 Afghanistan AFG    2011 new_sp_m04       2
##  3 Afghanistan AFG    2012 new_sp_m04       0
##  4 Albania     ALB    2005 new_sp_m04       0
##  5 Albania     ALB    2006 new_sp_m04       1
##  6 Albania     ALB    2007 new_sp_m04       0
##  7 Albania     ALB    2008 new_sp_m04       1
##  8 Albania     ALB    2009 new_sp_m04       0
##  9 Albania     ALB    2010 new_sp_m04       0
## 10 Albania     ALB    2011 new_sp_m04       0
## # ... with 51,452 more rows
```