Exercise: **ggplot Graphics**

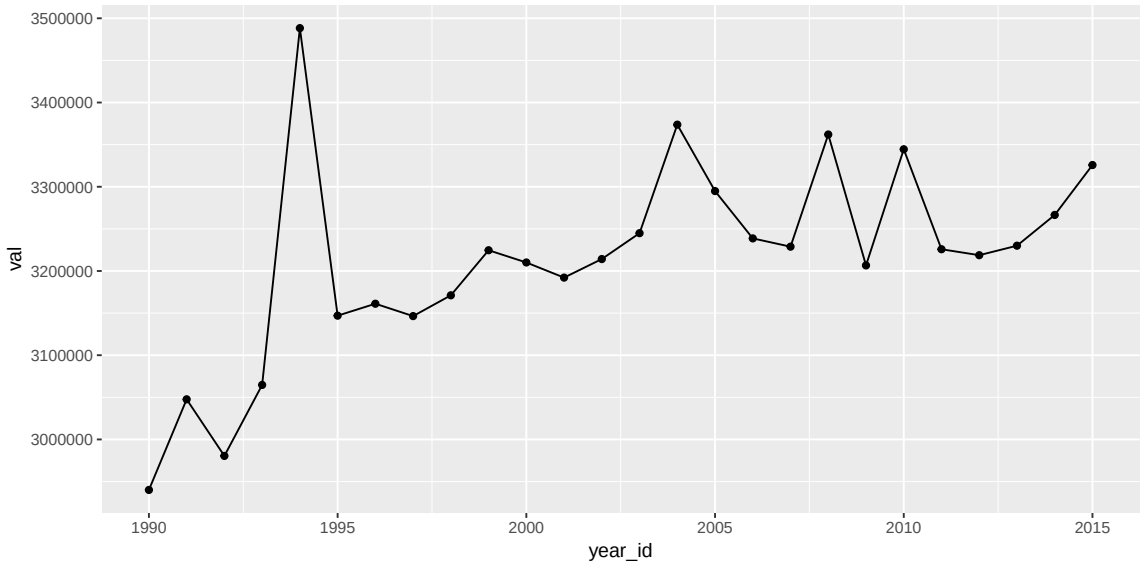
Day 3, Part A

1. Load GBD2015 global deaths data ("data/gbd2015_global_deaths.csv"). These are estimates of the total number of deaths globally over time, including uncertainty intervals, from GBD. Discuss at your table:

   - How many rows and columns are there?
   - What are the classes (variable types) of each column?
   - What is the range of values for the numeric columns?
   - What are the possible values for the factor columns?
   - What does a single row represent?

2. Subset the data to just rows that refer to injuries among males and store this as a new `data.frame`.

   a. Use this subset of the data to make a graph of the number of deaths (the `val` column) over time like the one below:

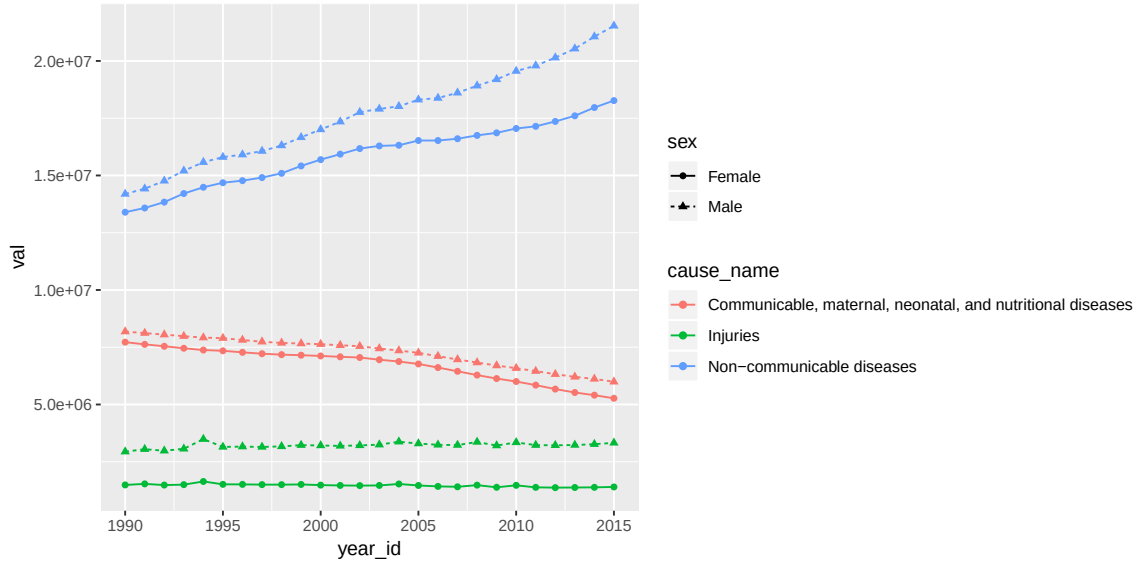


   b. Discuss at your table:

      - What are the `aesthetics` that need to be mapped to create this graph?
      - What are the `geoms` are involved in this graph?
      - What is the interpretation of this figure? Are there any notable years? What do you think might explain them?

3. Now using the full data,

   a. Recreate the graph below:

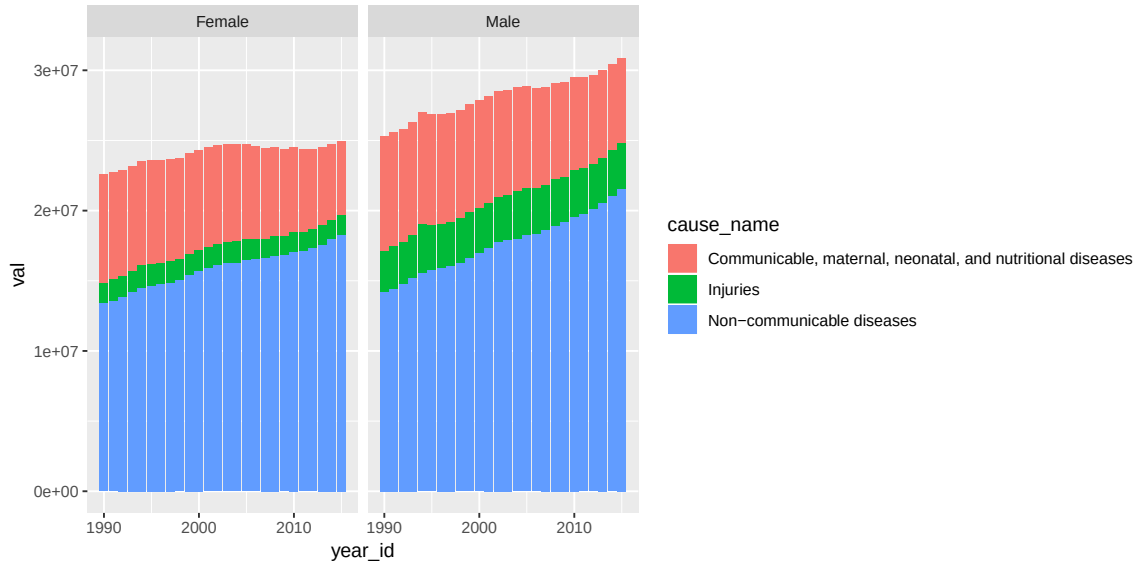


b. Discuss at your table:

- What are the `aesthetics` that need to be mapped to create this graph? (hint: there are three besides `x` and `y`, even though there are only two legends)
- What are the `geoms` are involved in this graph?
- What are the various ways you can interpret of this figure? What are the notable trends?

4. Using the same data,

a. Recreate the bar graph below (hint: use `stat = "identity"` in the `geom`):

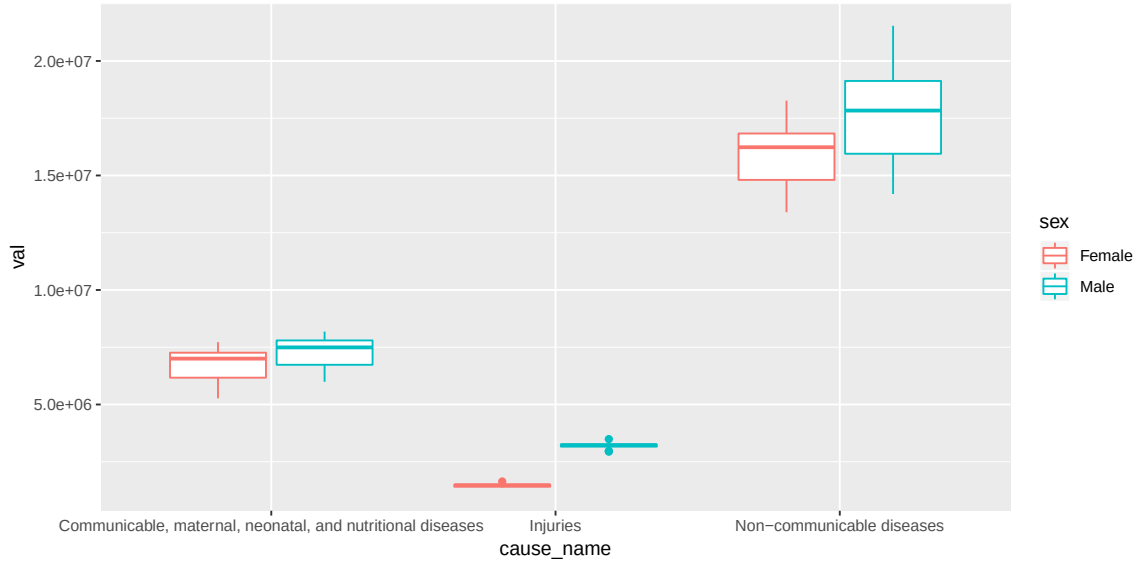


b. Discuss at your table:

- What are the `aesthetics` and `geoms` in this graph?
- What other variables appear in this graph? How?
- What would happen if you added `position='dodge'` to the `geom`? `position='fill'`?
- What are the various ways you can interpret of this figure? What are the notable trends?

5. Using the same data,

a. Recreate the box plot below:

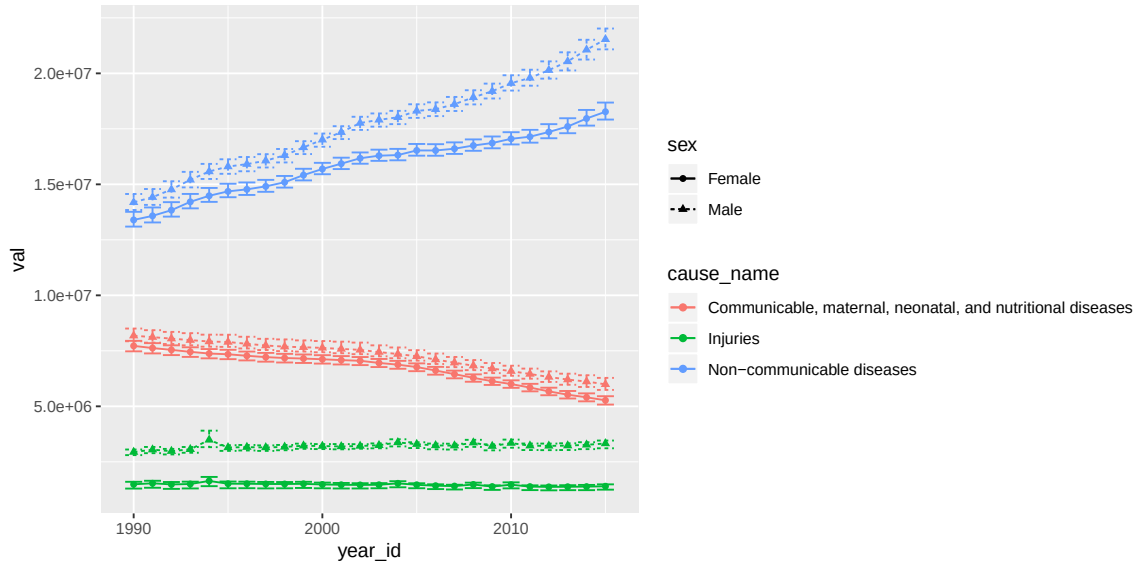


b. Discuss at your table:

- What are the `aesthetics` and `geoms` in this graph?
- What are the various ways you can interpret of this figure? What is the range representing in each boxplot?
- If you wanted to look at the range across diseases by year (rather than the other way around), what `aesthetics` would you change? (hint: boxplots work best with factor variables on the x-axis)

6. Using the same data,

a. Add error bars to the plot in question 3.



b. Discuss at your table:

- What are the `aesthetics` and `geoms` need to be added to this graph? (hint: look at the help file ?geom_errorbar to identify **required** aesthetics)
- What are the trends in uncertainty? Are there particular cause groups, sexes or years with more or less uncertainty?

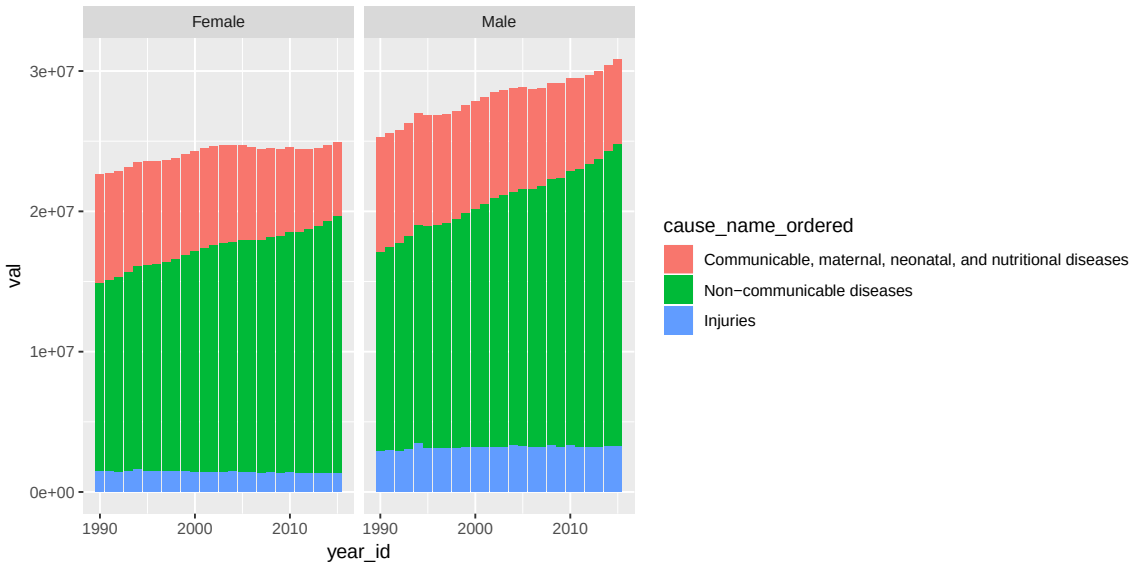
c. Now try displaying uncertainty as a "ribbon", rather than bar:

d. Discuss at your table:

- What order should the `geoms` appear to make sure everything is visible?
- How could you change the default color and transparency of the ribbon to make everything more visible?
- Does this alter any interpretations of uncertainty?
- Now that there are many things going on, I found it useful to label the graph better. What do you need to do to include all the labels I included? (notice that I also changed the legend titles)
- What happens if you give the `shape` aesthetic a different title than the `linetype` aesthetic?

Bonus Questions:

7. Change the order the causes are stacked in the plot in question 4 (communicable on the top, non-communicable in the middle, and injuries on the bottom).



Hint: this is a general R question, not a ggplot2 question

8. Make a "production ready" version of the stacked bar graph above (one that would be clean enough to publish)

- Use `brewer.pal` (from the `RColorBrewer` package), or choose your own colors to assign nicer colors

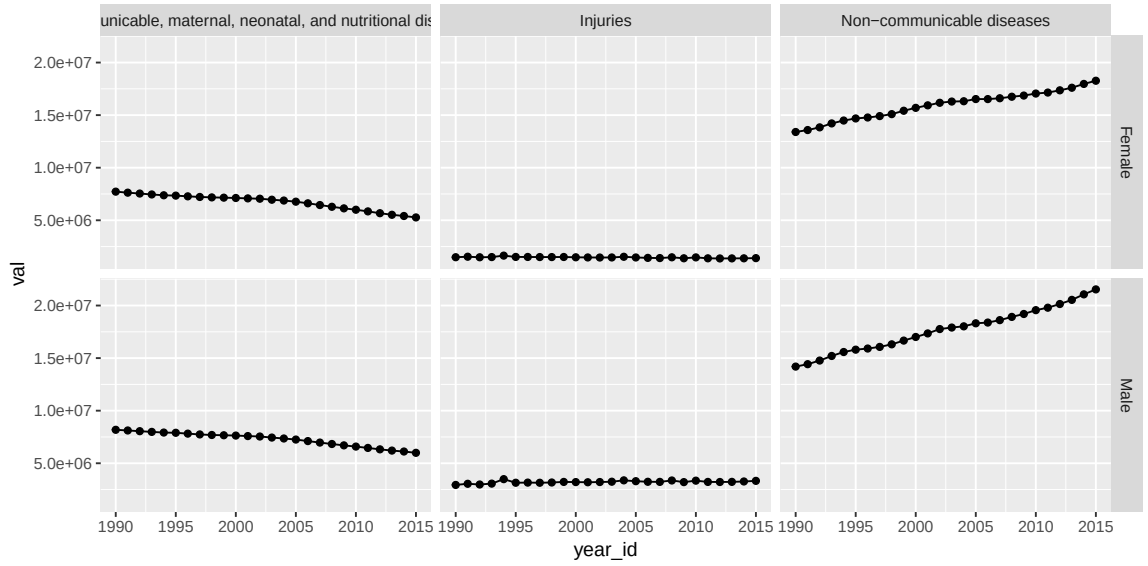
- Use `themes` to format the background and enlarge the text
- Use `labs` to provide better titles
- Use "on-the-fly" data manipulation to avoid scientific notation on the y-axis
- Use `str_wrap()` from the `stringr` package to wrap the text in the legend
- Use `theme(plot.caption=element_text(size=8, color='grey50'))` to modify the caption text separately

Hints:

```
- https://ggplot2.tidyverse.org/reference/scale_manual.html
- https://ggplot2.tidyverse.org/reference/theme.html
- http://colorbrewer2.org/
```

9. Explore more complex ways of creating `facets`.

   a. Can you figure out how to make a graph like the below?



   b. Or this one?