Visualization-solutions

You got this.

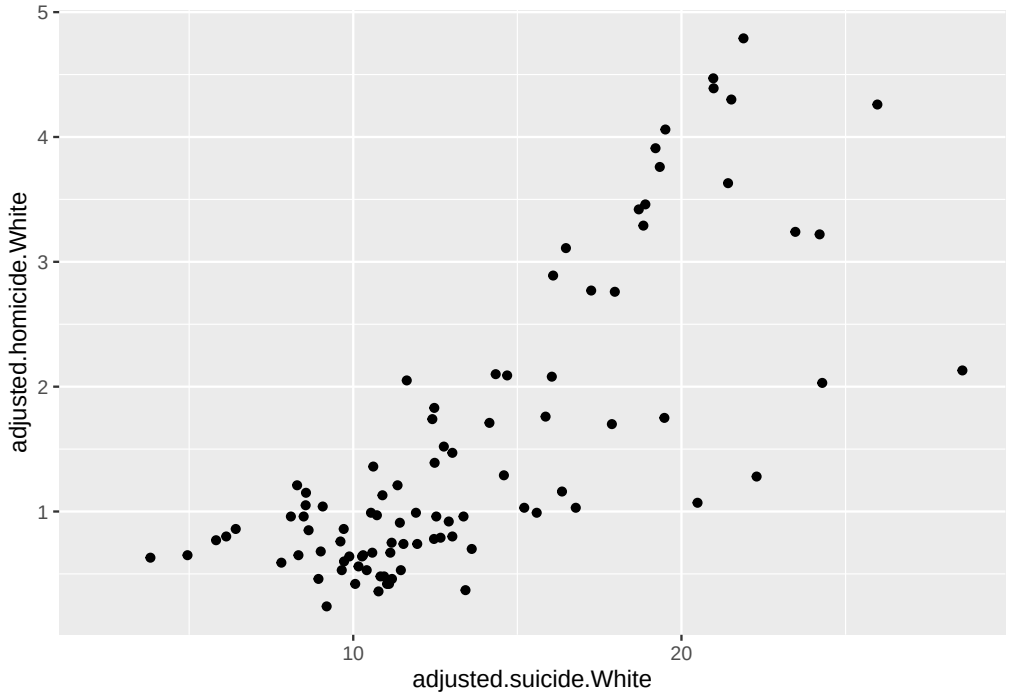
1. Don't worry about making it exactly, try and see how far you can get.
2. You're encouraged to work together if you want to and exchange tips/tricks you figured out.

I'll leave these here

- https://cran.r-project.org/web/packages/ggrepel/vignettes/ggrepel.html
- http://colorbrewer2.org
- You may need to use some `dplyr` skills from the first session

Build Figure 3: First add the points

```
library(tidyverse)
CDC_Males <- read_csv("../Data/CDC_Males.csv")
ggplot(data = CDC_Males,
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point()
```



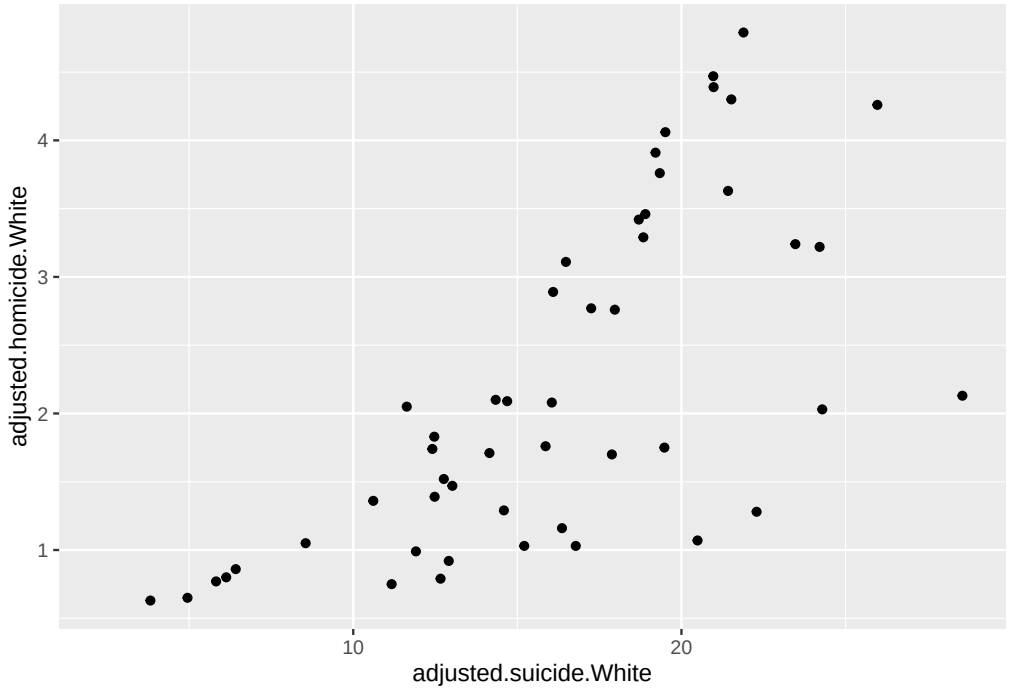
Build Figure 3: Are there too many points?

Notice there are too many points. Use the `dplyr` function called `filter` to subset to the firearm homicide and suicides only:

```
CDC_firearm_only <- CDC_Males %>% filter(type == "Firearm")

ggplot(data = CDC_firearm_only, aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point()
```

```
## Warning: Removed 2 rows containing missing values (geom_point).
```



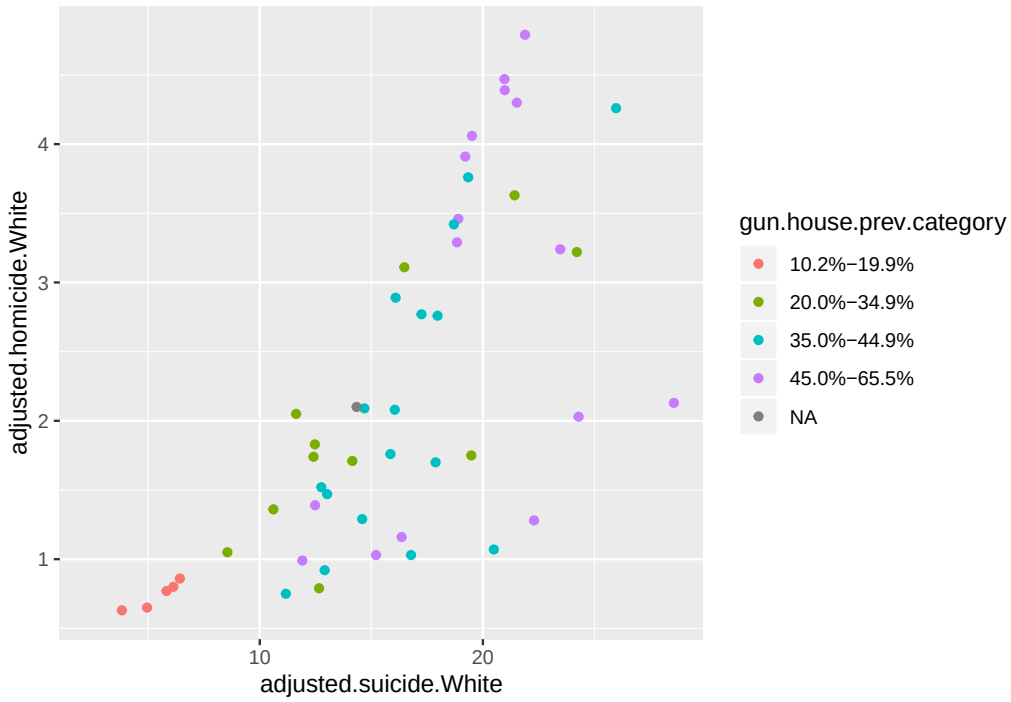
Build Figure 3: Color according to state gun prevalence

Link color to state gun prevalence. Try both continuous and categorical variables to see the difference. Remember, you need to do this inside the `aes()` function! Try putting it outside the aes() and see what happens.

i) Categorical version

```
#why is categorical data colours in a non-ordered way?
#do we want it to be ordered here?
ggplot(data = CDC_firearm_only,
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point(aes(col = gun.house.prev.category))
```

```
## Warning: Removed 2 rows containing missing values (geom_point).
```

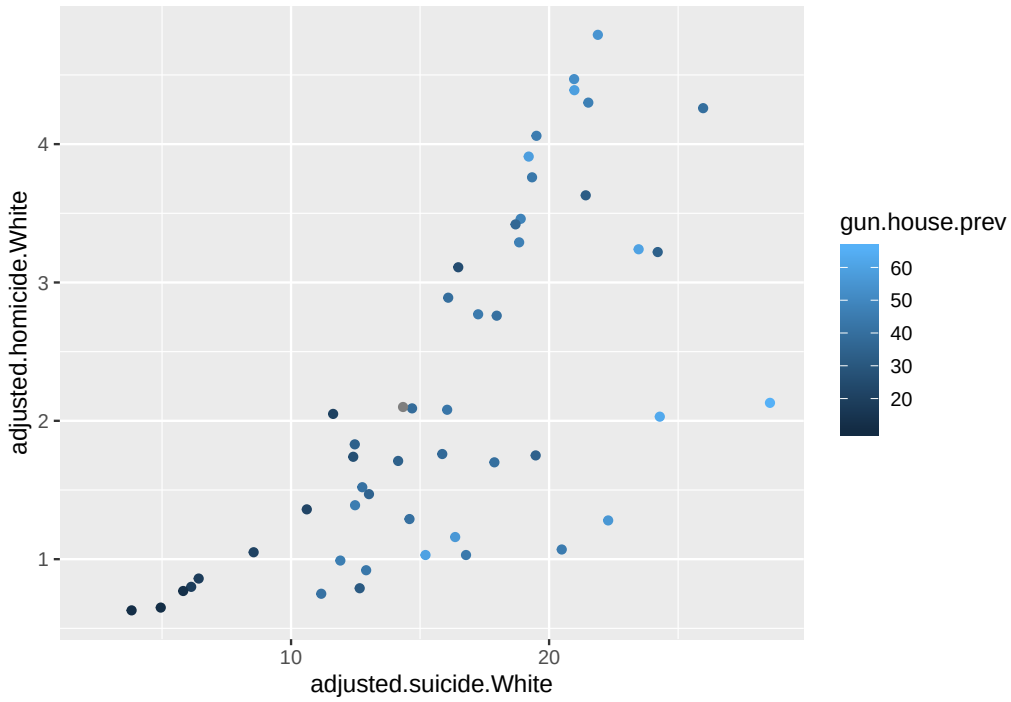


Build Figure 3: Color according to state gun prevalence

ii) Continuous version

```
# what is misleading here about the default?
# the darkest colours correspond to the lower values. Confusing!
ggplot(data = CDC_firearm_only,
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point(aes(col = gun.house.prev))
```

```
## Warning: Removed 2 rows containing missing values (geom_point).
```

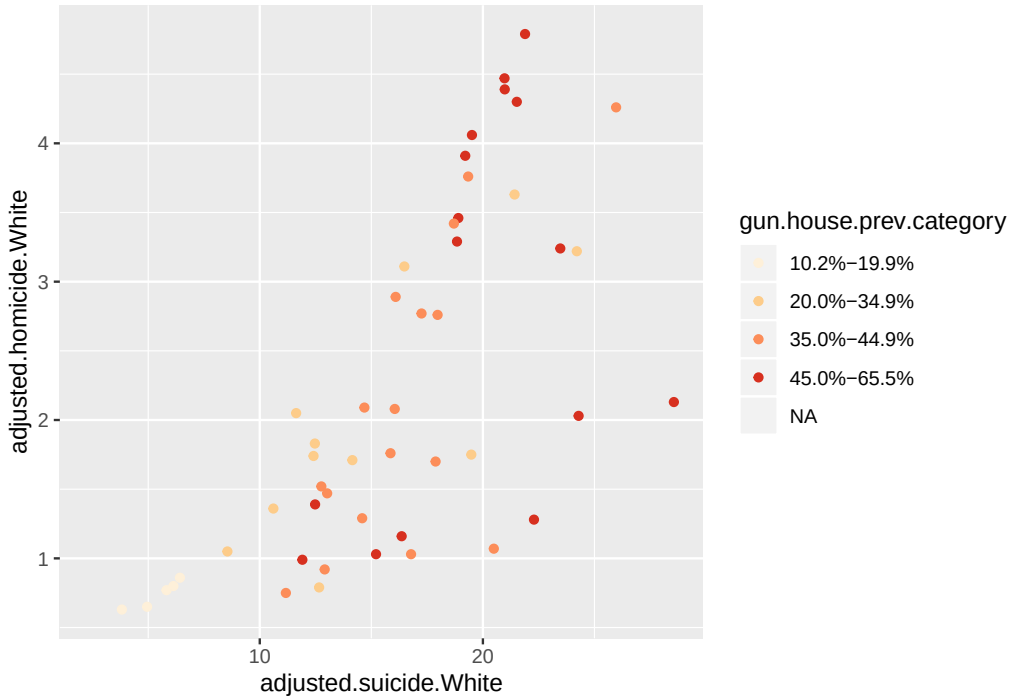


Build Figure 3: Color according to state gun prevalence

Set the colors manually. Do this inside of the scale function:

```
ggplot(data = CDC_firearm_only,
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point(aes(col = gun.house.prev.category)) +
  scale_color_manual(values = c('#fef0d9','#fdcc8a','#fc8d59','#d7301f'))
```

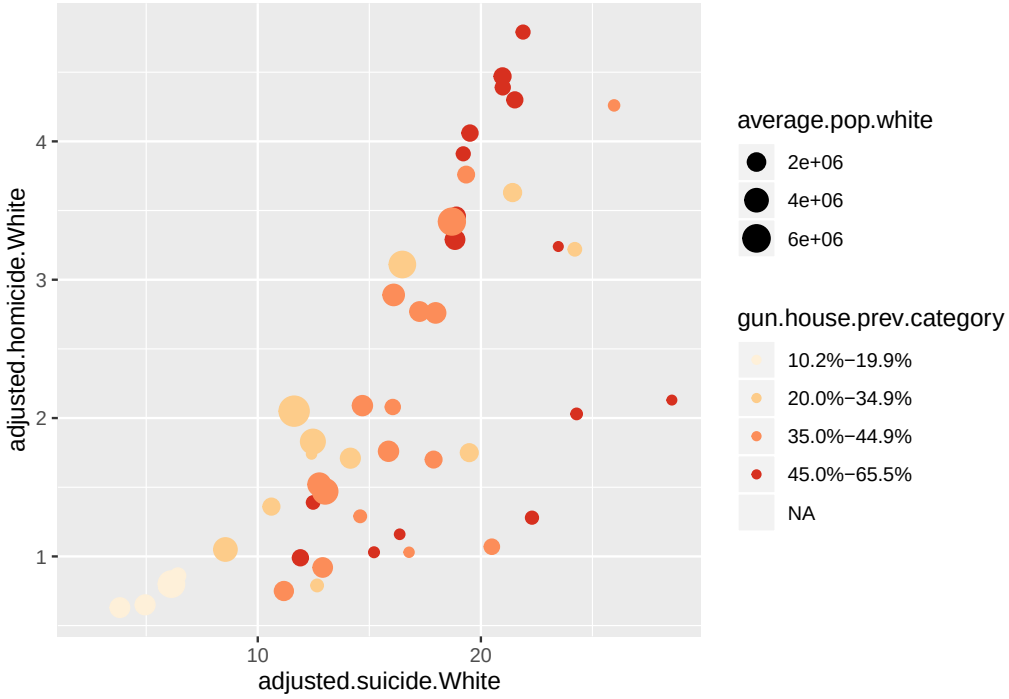
```
## Warning: Removed 3 rows containing missing values (geom_point).
```



Build Figure 3: Link to size

```
ggplot(data = CDC_firearm_only,
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point(aes(col = gun.house.prev.category, size = average.pop.white)) +
  scale_color_manual(values = c('#fef0d9','#fdcc8a','#fc8d59','#d7301f'))
```

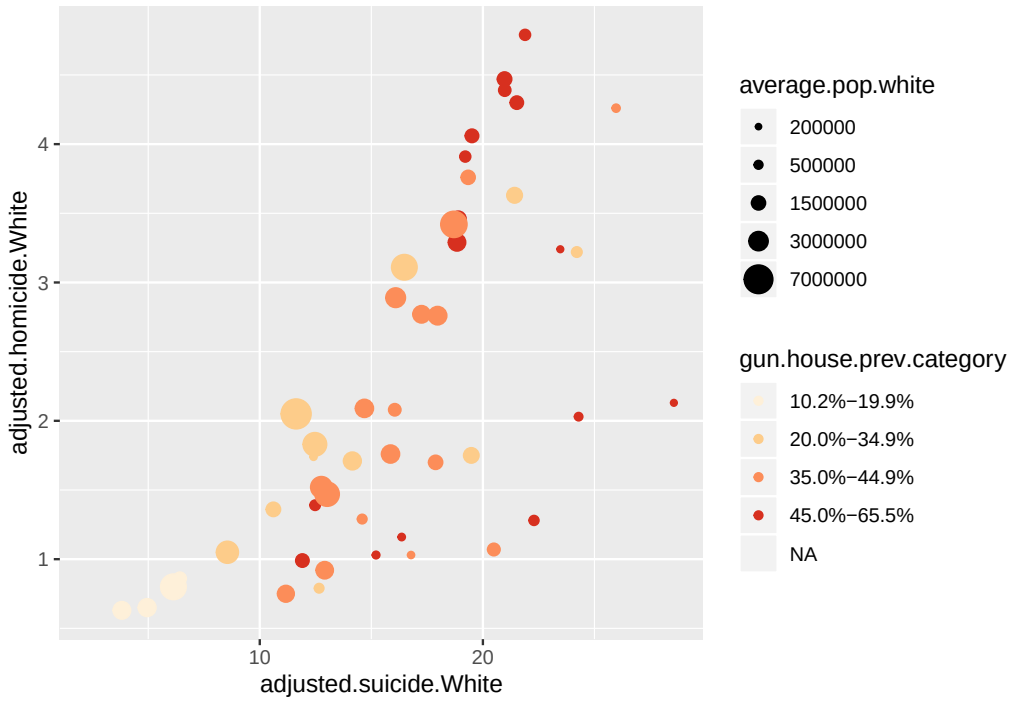
```
## Warning: Removed 3 rows containing missing values (geom_point).
```



Build Figure 3: Tell the size legend where to show the breaks

```
ggplot(data = CDC_firearm_only,
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point(aes(col = gun.house.prev.category, size = average.pop.white)) +
  scale_color_manual(values = c('#fef0d9','#fdcc8a','#fc8d59','#d7301f')) +
  scale_size_area(breaks = c(200000, 500000, 1500000, 3000000, 7000000))
```

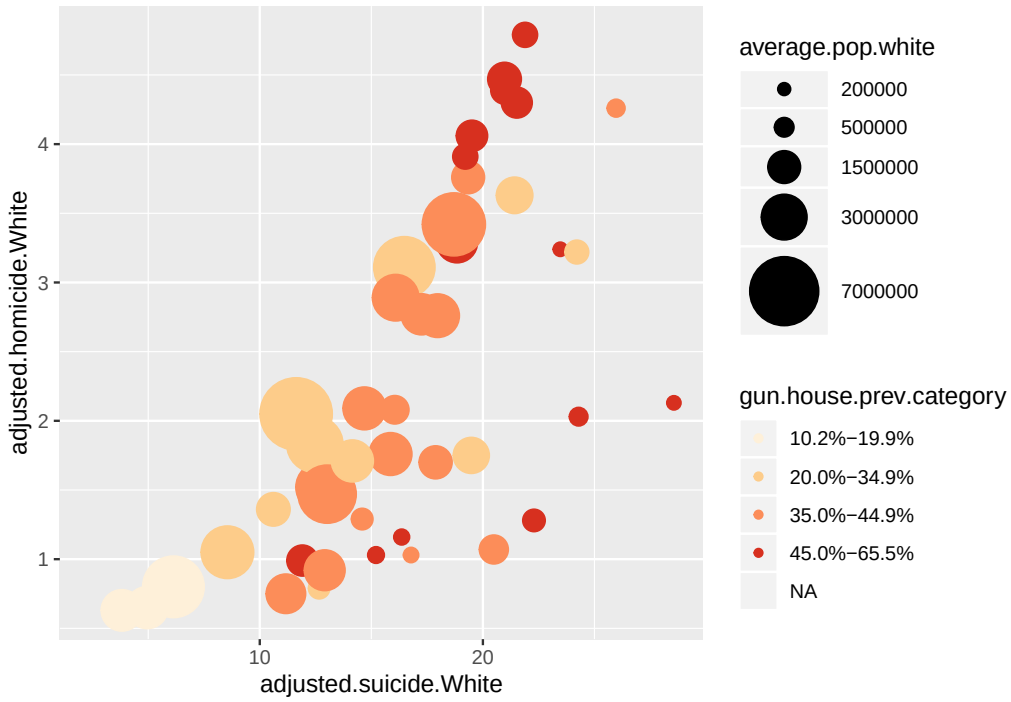
```
## Warning: Removed 3 rows containing missing values (geom_point).
```



Build Figure 3: Make the max size of the circles larger

```
ggplot(data = CDC_firearm_only,
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point(aes(col = gun.house.prev.category, size = average.pop.white)) +
  scale_color_manual(values = c('#fef0d9','#fdcc8a','#fc8d59','#d7301f')) +
  scale_size_area(breaks = c(200000, 500000, 1500000, 3000000, 7000000),
                  max_size = 15)
```

```
## Warning: Removed 3 rows containing missing values (geom_point).
```

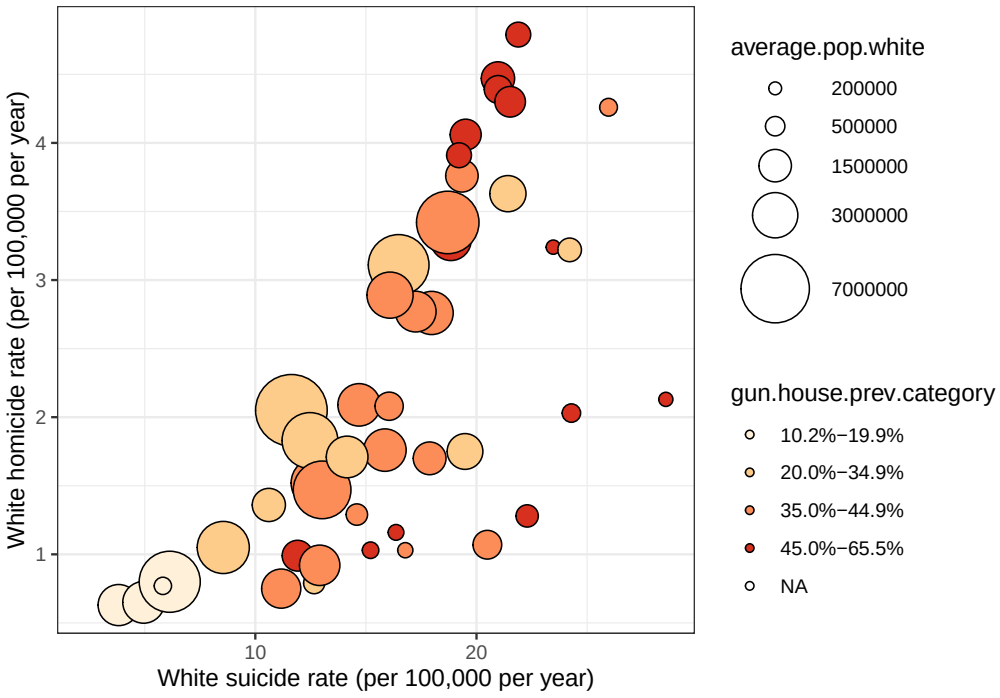


Build Figure 3: Add some tiny changes

- add the x and y axis labels inside `labs()`
- change the type of plotting point using `pch`. Then need to use fill instead of color for pch=21 (since this pch has both a fill and an outline)

```
ggplot(data = CDC_firearm_only,
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point(aes(fill = gun.house.prev.category, size = average.pop.white), pch = 21) +
  scale_fill_manual(values = c('#fef0d9','#fdcc8a','#fc8d59','#d7301f')) +
  scale_size_area(breaks = c(200000, 500000, 1500000, 3000000, 7000000),
                  max_size = 15) +
  theme_bw() +
  labs(x = "White suicide rate (per 100,000 per year)",
       y = "White homicide rate (per 100,000 per year)")
```

```
## Warning: Removed 3 rows containing missing values (geom_point).
```



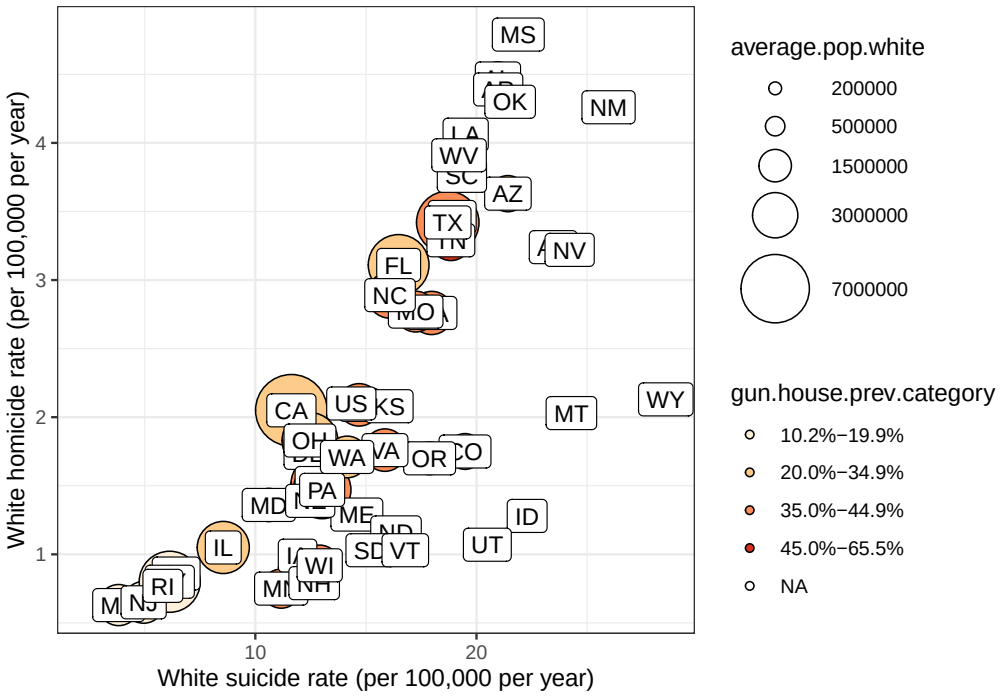
Build Figure 3: Add state labels with geom_text() or geom_label().

Try both and see how they differ.

```
ggplot(data = CDC_firearm_only,
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point(aes(fill = gun.house.prev.category, size = average.pop.white), pch = 21) +
  scale_fill_manual(values = c('#fef0d9','#fdcc8a','#fc8d59','#d7301f')) +
  scale_size_area(breaks = c(200000, 500000, 1500000, 3000000, 7000000),
                  max_size = 15) +
  theme_bw() +
  labs(x = "White suicide rate (per 100,000 per year)",
       y = "White homicide rate (per 100,000 per year)") +
  geom_label(aes(label = ST))
```

```
## Warning: Removed 3 rows containing missing values (geom_point).
```

```
## Warning: Removed 2 rows containing missing values (geom_label).
```



Build Figure 3: Introducing `ggrepel`

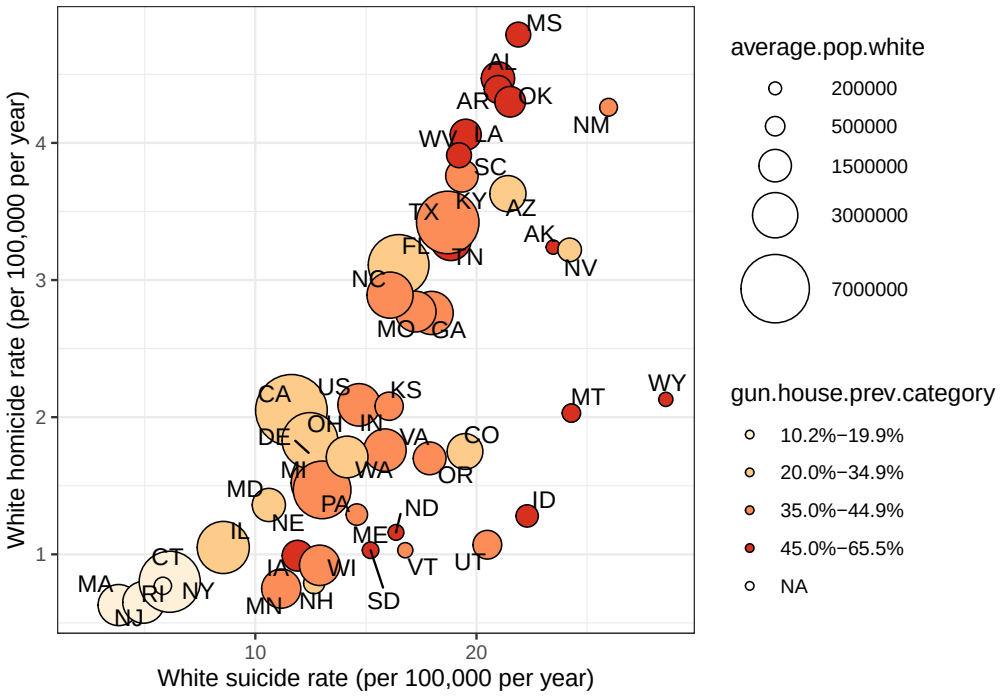
Use the package ggrepel to repel these labels away from one another and away from the data so they don't appear so crowded. Need to change geom_text (or geom_label) to geom_text_repel

```
library(ggrepel)

ggplot(data = CDC_firearm_only,
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point(aes(fill = gun.house.prev.category, size = average.pop.white), pch = 21) +
  scale_fill_manual(values = c('#fef0d9','#fdcc8a','#fc8d59','#d7301f')) +
  scale_size_area(breaks = c(200000, 500000, 1500000, 3000000, 7000000),
                  max_size = 15) +
  theme_bw() +
  labs(x = "White suicide rate (per 100,000 per year)",
       y = "White homicide rate (per 100,000 per year)") +
  geom_text_repel(aes(label = ST))
```

```
## Warning: Removed 3 rows containing missing values (geom_point).
```

```
## Warning: Removed 2 rows containing missing values (geom_text_repel).
```



Build Figure 3: Calculate Spearman's rank

Use this `dplyr` code to calculate the spearman's rank statistic and call it rho

```
corr <- cor.test(x = CDC_firearm_only %>%
                   filter(! ST %in% c("US", "HI", "DC")) %>%
                   select(adjusted.homicide.White) %>%
                   unlist(),
                 y = CDC_firearm_only %>%
                   filter(! ST %in% c("US", "HI", "DC")) %>%
                   select(adjusted.suicide.White) %>%
                   unlist(),
                 method = 'spearman')
```

```
## Warning in cor.test.default(x = CDC_firearm_only %>% filter(!ST %in%
## c("US", : Cannot compute exact p-value with ties
```

```
corr
```

```
##
##  Spearman's rank correlation rho
##
## data:  CDC_firearm_only %>% filter(!ST %in% c("US", "HI", "DC")) %>%  and CDC_firearm_only %>% filte
## S = 5035.6, p-value = 9.701e-10
## alternative hypothesis: true rho is not equal to 0
## sample estimates:
##       rho
## 0.7430802
```

```
rho <- corr$estimate
```

Build Figure 3: Introducing the glue package

`Glue` is a great package for gluing together words with variables:

```
library(glue)
glue("The Spearman's rank coefficient is:{rho}")
```

```
## The Spearman's rank coefficient is:0.743080180858652
```

```
glue("The Spearman's rank coefficient is:{round(rho, 2)}")
```

```
## The Spearman's rank coefficient is:0.74
```

Build Figure 3: Add Spearman's rank to the plot

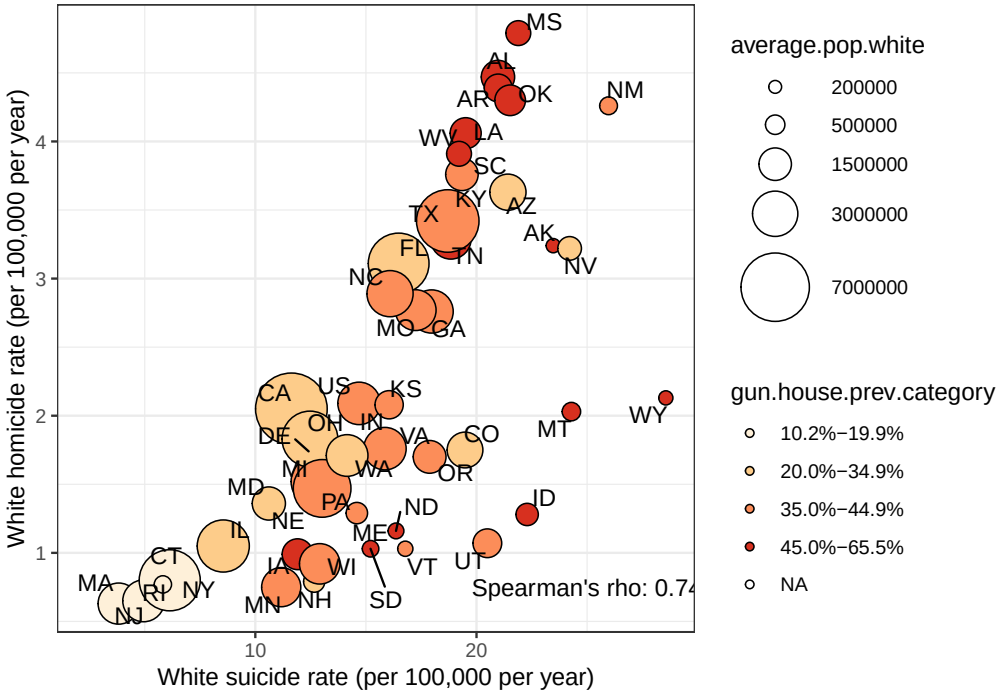
Add rho to the plot using `geom_text()`:

- You need to supply x and y in this `aes()` to tell the text where to plot it
- You need to also say check_overlap = T or else it will plot it for each row of the data and appear bolded (try removing check_overlap = T)

```
ggplot(data = CDC_firearm_only,
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point(aes(fill = gun.house.prev.category, size = average.pop.white), pch = 21) +
  scale_fill_manual(values = c('#fef0d9','#fdcc8a','#fc8d59','#d7301f')) +
  scale_size_area(breaks = c(200000, 500000, 1500000, 3000000, 7000000),
                  max_size = 15) +
  theme_bw() +
  labs(x = "White suicide rate (per 100,000 per year)",
       y = "White homicide rate (per 100,000 per year)") +
  geom_text_repel(aes(label = ST)) +
  geom_text(aes(x = 25, y = 0.75, label = glue("Spearman's rho: {round(rho, 2)}")), check_overlap = T)
```

```
## Warning: Removed 3 rows containing missing values (geom_point).
```

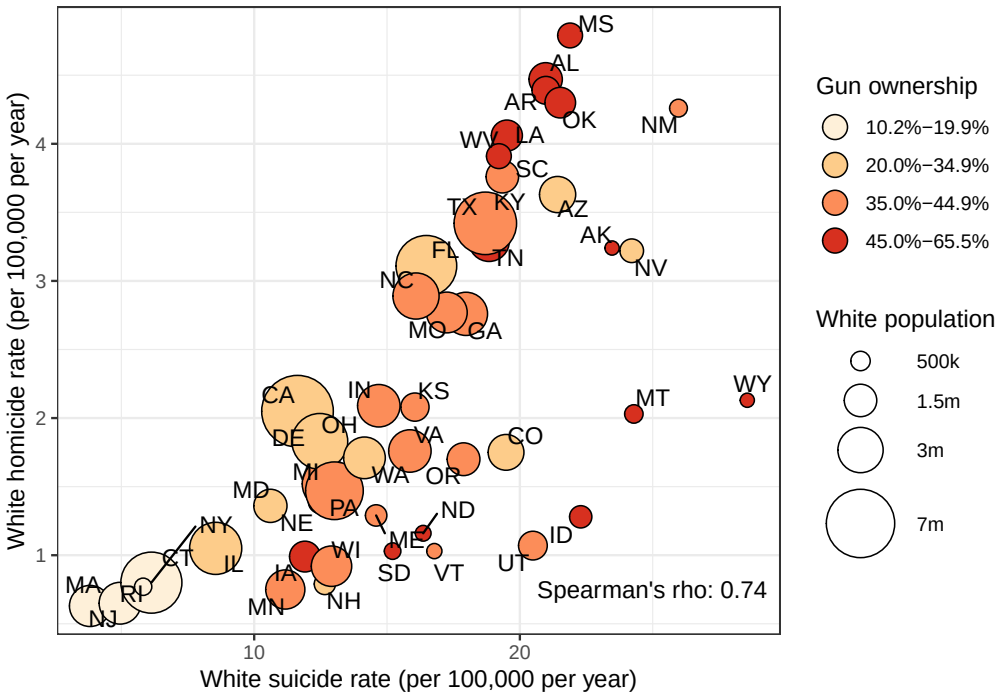
```
## Warning: Removed 2 rows containing missing values (geom_text_repel).
```



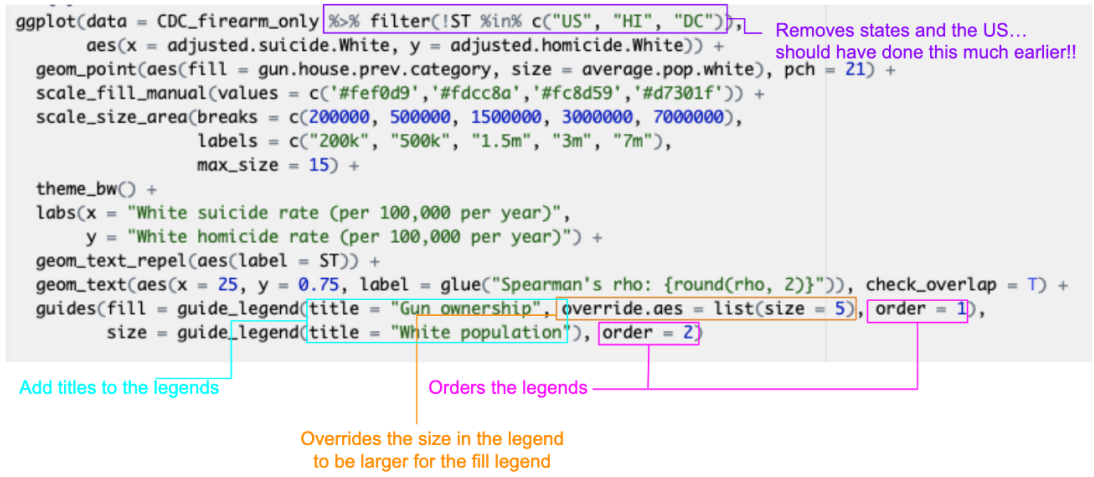
Build Figure 3: Make the legend pretty

- The next slide annotates this code to show which bits affect the legend.

```
ggplot(data = CDC_firearm_only %>% filter(!ST %in% c("US", "HI", "DC")),
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point(aes(fill = gun.house.prev.category, size = average.pop.white), pch = 21) +
  scale_fill_manual(values = c('#fef0d9','#fdcc8a','#fc8d59','#d7301f')) +
  scale_size_area(breaks = c(200000, 500000, 1500000, 3000000, 7000000),
                  labels = c("200k", "500k", "1.5m", "3m", "7m"),
                  max_size = 15) +
  theme_bw() +
  labs(x = "White suicide rate (per 100,000 per year)",
       y = "White homicide rate (per 100,000 per year)") +
  geom_text_repel(aes(label = ST)) +
  geom_text(aes(x = 25, y = 0.75, label = glue("Spearman's rho: {round(rho, 2)}")), check_overlap = T) +
  guides(fill = guide_legend(title = "Gun ownership", override.aes = list(size = 5)), order = 1),
         size = guide_legend(title = "White population"), order = 2)
```



Build Figure 3: Make the legend pretty



Save figure 3

This code will only work if you add a Plots folder inside of your main folder!

```
figure.3 <- ggplot(data = CDC_firearm_only %>% filter(!ST %in% c("US", "HI", "DC")),
       aes(x = adjusted.suicide.White, y = adjusted.homicide.White)) +
  geom_point(aes(fill = gun.house.prev.category, size = average.pop.white), pch = 21) +
  scale_fill_manual(values = c('#fef0d9','#fdcc8a','#fc8d59','#d7301f')) +
  scale_size_area(breaks = c(200000, 500000, 1500000, 3000000, 7000000),
                  labels = c("200k", "500k", "1.5m", "3m", "7m"),
                  max_size = 15) +
  theme_bw() +
  labs(x = "White suicide rate (per 100,000 per year)",
       y = "White homicide rate (per 100,000 per year)") +
  geom_text_repel(aes(label = ST)) +
  geom_text(aes(x = 25, y = 0.75, label = glue("Spearman's rho: {round(rho, 2)}")), check_overlap = T) +
  guides(fill = guide_legend(title = "Gun ownership", override.aes = list(size = 5), order = 1),
         size = guide_legend(title = "White population"), order = 2)

ggsave(filename = "../Plots/figure3.jpeg", plot = figure.3, device = "jpeg", width = 8, height = 6, uni
```