

Reading in data with **readr** and **haven**

Session 6

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Load the packages, as always

```
library(here)      # manage file paths
```

```
## here() starts at /Users/kjhealy/Documents/courses/data_wrangling
```

```
library(socviz)    # data and some useful functions
```

```
##
```

```
## Attaching package: 'socviz'
```

```
## The following object is masked from 'package:kjhutils':
```

```
##
```

```
##      %nin%
```

```
library(tidyverse) # your friend and mine
```

```
## — Attaching packages ————— tidyverse 1.3.1 —
```

```
## ✓ ggplot2 3.3.5      ✓ purrr  0.3.4
```

```
## ✓ tibble  3.1.4      ✓ dplyr  1.0.7
```

```
## ✓ tidyr   1.1.3      ✓ stringr 1.4.0
```

```
## ✓ readr   2.0.1      ✓ forcats 0.5.1
```

```
## — Conflicts ————— tidyverse_conflicts() —
```

```
## x readr::edition_get() masks testthat::edition_get()
```

```
## x dplyr::filter()      masks stats::filter()
```

```
## x purrr::is_null()     masks testthat::is_null()
```

```
## x dplyr::lag()         masks stats::lag()
```

```
## x readr::local_edition() masks testthat::local_edition()
```

```
## x dplyr::matches()     masks tidyr::matches(), testthat::matches()
```

```
library(haven)     # for Stata, SAS, and SPSS files
```

We've put a lot of pieces in place at this point

Including several things we haven't fully exploited yet

Data we want to get into R

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Nice, clean CSV files.

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More troublesome CSVs.

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Quite messy things like tables on web pages.

Data we want to get into R

Nice, clean CSV files.

More troublesome CSVs.

Other plain-text formats.

Foreign formats, like Stata.

Quite messy things like tables on web pages.

... and more besides.

Reading in CSV files

CSV is not really a proper format at all!

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Base R has `read.csv()`

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Base R has `read.csv()`

As is often the case, the tidyverse has a corresponding "underscored" version, `read_csv()`. It is *much* pickier and more talkative than the Base R version.

Where's the data? Using **here()**

If we're loading a file, it's coming from *somewhere*.

If it's on our local disk somewhere, we will need to interact with the file system. We should try to do this in a way that avoids *absolute* file paths.

```
# This is not portable  
df <- read_csv("/Users/kjhealy/Documents/data/misc/project/data/mydata.csv")
```

Where's the data? Using **here()**

If we're loading a file, it's coming from *somewhere*.

If it's on our local disk somewhere, we will need to interact with the file system. We should try to do this in a way that avoids *absolute* file paths.

```
# This is not portable  
df <- read_csv("/Users/kjhealy/Documents/data/misc/project/data/mydata.csv")
```

We should also do it in a way that is *platform independent*.

This makes it easier to share your work, move it around, etc. Projects should be self-contained.

Where's the data? Using **here()**

The `here` package, and `here()` function builds paths relative to the top level of your R project.

```
here() # this path will be different for you
```

```
## [1] "/Users/kjhealy/Documents/courses/data_wrangling"
```


Where's the data? Using **here()**

This seminar's files all live in an RStudio project. It looks like this:

```
## /Users/kjhealy/Documents/courses/data_wrangling
## |— LICENSE
## |— README.Rmd
## |— README.md
## |— code
## |— course_notes.Rmd
## |— course_notes.html
## |— data
## |— data_wrangling.Rproj
## |— docs
## |— office
## |— pdf_slides
## |— r_code
## |— scratch.Rmd
## |— scratch.docx
## |— scratch.html
## |— scratch.log
## |— scratch.pdf
## |— scratch.tex
## |— slides
```

I want to load files from the `data` folder, but I also want *you* to be able to load

Where's the data? Using **here()**

So:

```
## Load the file relative to the path from the top of the project, without separators, etc  
organs <- read_csv(file = here("data", "organdonation.csv"))
```

Where's the data? Using **here()**

So:

```
## Load the file relative to the path from the top of the project, without separators, etc
organs <- read_csv(file = here("data", "organdonation.csv"))
```

organs

```
## # A tibble: 238 × 21
```

```
##   country   year donors  pop pop.dens  gdp gdp.lag health health.lag pubhealth
##   <chr>     <dbl> <dbl> <dbl>    <dbl> <dbl> <dbl> <dbl>    <dbl>    <dbl>
## 1 Australia   NA   NA   17065    0.220 16774  16591  1300    1224     4.8
## 2 Australia 1991  12.1 17284    0.223 17171  16774  1379    1300     5.4
## 3 Australia 1992  12.4 17495    0.226 17914  17171  1455    1379     5.4
## 4 Australia 1993  12.5 17667    0.228 18883  17914  1540    1455     5.4
## 5 Australia 1994  10.2 17855    0.231 19849  18883  1626    1540     5.4
## 6 Australia 1995  10.2 18072    0.233 21079  19849  1737    1626     5.5
## 7 Australia 1996  10.6 18311    0.237 21923  21079  1846    1737     5.6
## 8 Australia 1997  10.3 18518    0.239 22961  21923  1948    1846     5.7
## 9 Australia 1998  10.5 18711    0.242 24148  22961  2077    1948     5.9
## 10 Australia 1999   8.67 18926    0.244 25445  24148  2231    2077     6.1
## # ... with 228 more rows, and 11 more variables: roads <dbl>, cerebvas <dbl>,
## # assault <dbl>, external <dbl>, txp.pop <dbl>, world <chr>, opt <chr>,
## # consent.law <chr>, consent.practice <chr>, consistent <chr>, ccode <chr>
```

And there it is.

Where's the data? Using **here()**

Get in the habit of putting this at the top of your files:

```
here::i_am("analysis.Rmd") # or whatever your Rmd or R file is called
```

See [the here project page](#) for more details.

read_csv() comes in different varieties

`read_csv()` Field separator is ,

```
organs <- read_csv(file = here("data", "organdonation.csv"))
```

`read_csv2()` Field separator is ;

```
# Example only  
my_data <- read_csv2(file = here("data", "my_euro_file.csv"))
```

Both are special cases of `read_delim()`

Other species are also catered to

`read_tsv()` Tab separated.

`read_fwf()` Fixed-width files.

`read_log()` Log files (i.e. computer log files).

`read_lines()` Just read in lines, without trying to parse them.

Also often useful ...

`read_table()` and `read_table2()`

Data that's separated by one (or more) columns of space.

You can read files remotely, too

You can give all of these functions local files, or they can point to URLs.

Compressed files will be automatically uncompressed.

(Be careful what you download from remote locations!)

```
organ_remote <- read_csv("http://kjhealy.co/organdonation.csv")
```

```
organ_remote
```

```
## # A tibble: 238 × 21
```

```
##   country    year donors  pop pop.dens  gdp gdp.lag health health.lag pubhealth
##   <chr>      <dbl> <dbl> <dbl>    <dbl> <dbl> <dbl> <dbl>    <dbl>    <dbl>
## 1 Australia    NA  NA   17065  0.220 16774 16591 1300    1224     4.8
## 2 Australia 1991 12.1 17284  0.223 17171 16774 1379    1300     5.4
## 3 Australia 1992 12.4 17495  0.226 17914 17171 1455    1379     5.4
## 4 Australia 1993 12.5 17667  0.228 18883 17914 1540    1455     5.4
## 5 Australia 1994 10.2 17855  0.231 19849 18883 1626    1540     5.4
## 6 Australia 1995 10.2 18072  0.233 21079 19849 1737    1626     5.5
## 7 Australia 1996 10.6 18311  0.237 21923 21079 1846    1737     5.6
## 8 Australia 1997 10.3 18518  0.239 22961 21923 1948    1846     5.7
## 9 Australia 1998 10.5 18711  0.242 24148 22961 2077    1948     5.9
## 10 Australia 1999  8.67 18926  0.244 25445 24148 2231    2077     6.1
```

```
## # ... with 228 more rows, and 11 more variables: roads <dbl>, cerebvas <dbl>,
```

```
## # assault <dbl>, external <dbl>, txp.pop <dbl>, world <chr>, opt <chr>,
```

```
## # consent.law <chr>, consent.practice <chr>, consistent <chr>, ccode <chr>
```


An example: `read_table()`

England and Wales, Total Population, Death rates (period 1x1), Last modified: 02 Apr 2018; Methods Protocol: v6 (2017)

Year	Age	Female	Male	Total
1841	0	0.136067	0.169189	0.152777
1841	1	0.059577	0.063208	0.061386
1841	2	0.036406	0.036976	0.036689
1841	3	0.024913	0.026055	0.025480
1841	4	0.018457	0.019089	0.018772
1841	5	0.013967	0.014279	0.014123
1841	6	0.010870	0.011210	0.011040
1841	7	0.008591	0.008985	0.008788
1841	8	0.006860	0.007246	0.007053
1841	9	0.005772	0.006050	0.005911
1841	10	0.005303	0.005382	0.005343
1841	11	0.005114	0.005002	0.005057
1841	12	0.005145	0.004856	0.004999
1841	13	0.005455	0.004955	0.005202

1841	105	0.576967	1.727848	0.700373
1841	106	0.677711	6.000000	0.795287
1841	107	0.900000	.	0.900000
1841	108	1.388430	.	1.388430
1841	109	.	.	.
1841	110+	.	.	.
1842	0	0.148491	0.184007	0.166481
1842	1	0.063038	0.066596	0.064818
1842	2	0.035203	0.035854	0.035527

An example: `read_table()`

England and Wales, Total Population, Death rates (period 1x1), Last modified: 02 Apr 2018; Methods Protocol: v6 (2017)

Year	Age	Female	Male	Total
1841	0	0.136067	0.169189	0.152777
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1841	4	0.018457	0.019089	0.018772
1841	5	0.013967	0.014279	0.014123
1841	6	0.010870	0.011210	0.011040
1841	7	0.008591	0.008985	0.008788
1841	8	0.006860	0.007246	0.007053
1841	9	0.005772	0.006050	0.005911
1841	10	0.005303	0.005382	0.005343
1841	11	0.005114	0.005002	0.005057
1841	12	0.005145	0.004856	0.004999
1841	13	0.005455	0.004955	0.005202

1841	105	0.576967	1.727848	0.700373
1841	106	0.677711	6.000000	0.795287
1841	107	0.900000	.	0.900000
1841	108	1.388430	.	1.388430
1841	109	.	.	.
1841	110+	.	.	.
1842	0	0.148491	0.184007	0.166481
1842	1	0.063038	0.066596	0.064818
1842	2	0.035203	0.035854	0.035527

```
engmort <- read_table(here("data", "mortality.txt"),  
                      skip = 2, na = ".")
```

```
engmort
```

```
## # A tibble: 222 × 5
```

##		Year	Age	Female	Male	Total
##		<dbl>	<chr>	<dbl>	<dbl>	<dbl>
##	1	1841	0	0.136	0.169	0.153
##	2	1841	1	0.0596	0.0632	0.0614
##	3	1841	2	0.0364	0.0370	0.0367
##	4	1841	3	0.0249	0.0261	0.0255
##	5	1841	4	0.0185	0.0191	0.0188
##	6	1841	5	0.0140	0.0143	0.0141
##	7	1841	6	0.0109	0.0112	0.0110
##	8	1841	7	0.00859	0.00898	0.00879
##	9	1841	8	0.00686	0.00725	0.00705
##	10	1841	9	0.00577	0.00605	0.00591
##	#	... with 212 more rows				

Pay attention to the **column specification**

```
engmort <- read_table(here("data", "mortality.txt"),  
                      skip = 2, na = ".")
```

```
##  
## — Column specification —————  
## cols(  
##   Year = col_double(),  
##   Age = col_character(),  
##   Female = col_double(),  
##   Male = col_double(),  
##   Total = col_double()  
## )
```

The column specification tells you what the read function did. That is, how it interpreted each of the columns. It will also report if things don't go as expected.

Pay attention to the **column specification**

```
engmort <- read_table(here("data", "mortality.txt"),  
                      skip = 2, na = ".")
```

```
##  
## — Column specification —————  
## cols(  
##   Year = col_double(),  
##   Age = col_character(),  
##   Female = col_double(),  
##   Male = col_double(),  
##   Total = col_double()  
## )
```

The column specification tells you what the read function did. That is, how it interpreted each of the columns. It will also report if things don't go as expected.

Why is age imported in `character` format?

Pay attention to the **column specification**

Absent you giving them a column specification, the `read_` functions try to *guess* what the type of each column is. They do this by looking at the first thousand rows of each column.

They may guess incorrectly!

Normalizing names and recoding

```
read_table(here("data", "mortality.txt"),  
           skip = 2, na = ".")
```

```
## # A tibble: 222 × 5  
##   Year Age   Female   Male   Total  
##   <dbl> <chr>   <dbl>   <dbl> <dbl>  
## 1  1841 0     0.136   0.169   0.153  
## 2  1841 1     0.0596  0.0632  0.0614  
## 3  1841 2     0.0364  0.0370  0.0367  
## 4  1841 3     0.0249  0.0261  0.0255  
## 5  1841 4     0.0185  0.0191  0.0188  
## 6  1841 5     0.0140  0.0143  0.0141  
## 7  1841 6     0.0109  0.0112  0.0110  
## 8  1841 7     0.00859 0.00898 0.00879  
## 9  1841 8     0.00686 0.00725 0.00705  
## 10 1841 9     0.00577 0.00605 0.00591  
## # ... with 212 more rows
```

Normalizing names and recoding

```
read_table(here("data", "mortality.txt"),  
           skip = 2, na = ".") %>%  
  janitor::clean_names()
```

```
## # A tibble: 222 × 5  
##   year age  female  male  total  
##   <dbl> <chr>   <dbl>  <dbl> <dbl>  
## 1  1841 0     0.136  0.169  0.153  
## 2  1841 1     0.0596 0.0632 0.0614  
## 3  1841 2     0.0364 0.0370 0.0367  
## 4  1841 3     0.0249 0.0261 0.0255  
## 5  1841 4     0.0185 0.0191 0.0188  
## 6  1841 5     0.0140 0.0143 0.0141  
## 7  1841 6     0.0109 0.0112 0.0110  
## 8  1841 7     0.00859 0.00898 0.00879  
## 9  1841 8     0.00686 0.00725 0.00705  
## 10 1841 9     0.00577 0.00605 0.00591  
## # ... with 212 more rows
```

Normalizing names and recoding

```
read_table(here("data", "mortality.txt"),
           skip = 2, na = ".") %>%
  janitor::clean_names() %>%
  mutate(age = as.integer(recode(age, "110+" = "110")))
```

```
## # A tibble: 222 × 5
##   year age female male total
##   <dbl> <int>   <dbl>   <dbl>   <dbl>
## 1 1841     0 0.136 0.169 0.153
## 2 1841     1 0.0596 0.0632 0.0614
## 3 1841     2 0.0364 0.0370 0.0367
## 4 1841     3 0.0249 0.0261 0.0255
## 5 1841     4 0.0185 0.0191 0.0188
## 6 1841     5 0.0140 0.0143 0.0141
## 7 1841     6 0.0109 0.0112 0.0110
## 8 1841     7 0.00859 0.00898 0.00879
## 9 1841     8 0.00686 0.00725 0.00705
## 10 1841     9 0.00577 0.00605 0.00591
## # ... with 212 more rows
```


Normalizing names and recoding

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read_table(here("data", "mortality.txt"),
           skip = 2, na = ".") %>%
  janitor::clean_names() %>%
  mutate(age = as.integer(recode(age, "110+" = "110")))
```


```
## # A tibble: 222 × 5
##   year age female male total
##   <dbl> <int>   <dbl>   <dbl>   <dbl>
## 1 1841     0 0.136 0.169 0.153
## 2 1841     1 0.0596 0.0632 0.0614
## 3 1841     2 0.0364 0.0370 0.0367
## 4 1841     3 0.0249 0.0261 0.0255
## 5 1841     4 0.0185 0.0191 0.0188
## 6 1841     5 0.0140 0.0143 0.0141
## 7 1841     6 0.0109 0.0112 0.0110
## 8 1841     7 0.00859 0.00898 0.00879
## 9 1841     8 0.00686 0.00725 0.00705
## 10 1841     9 0.00577 0.00605 0.00591
## # ... with 212 more rows
```

The `janitor` package is very handy!

The main cost of normalizing names comes with, e.g., data where there is a codebook you need to consult. But in general it's worth it.

More on column specifications

CDC/NCHS data: Provisional COVID-19 Death Counts by Sex, Age, and State

 Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

Data.CDC.gov

[Home](#) [Data Catalog](#) [Developers](#) [Video Guides](#)

[Sign In](#)

Provisional COVID-19 Death Counts by Sex,
Age, and State NCHS

[View Data](#) [Visualize](#) [Export](#) [API](#) [...](#)

Deaths involving coronavirus disease 2019 (COVID-19), pneumonia, and influenza reported to NCHS by sex and age group and state.

NOTICE TO USERS: As of September 2, 2020, this data file includes the following age groups
[More](#)

Updated
April 14, 2021

Data Provided by
National Center for Health Statistics

More on column specifications

What's in this Dataset?

Rows
52.3K

Columns
16

Columns in this Dataset

Column Name	Description	Type	
Data As Of	Date of analysis	Date & Time	📅
Start Date	First date of data period	Date & Time	📅
End Date	Last date of data period	Date & Time	📅
Group	Indicator of whether data measured by Month, by Year, or ...	Plain Text	T
Year	Year in which death occurred	Number	#
Month	Month in which death occurred	Number	#

Let's try to load it

```
nchs <- with_edition(1, read_csv(here("data", "SAS_on_2021-04-13.csv")))
```

```
## Warning: 88128 parsing failures.
```

```
## row col expected actual file
## 2755 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data_wrangling/data/SAS_on_2021-04-13.csv'
## 2756 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data_wrangling/data/SAS_on_2021-04-13.csv'
## 2757 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data_wrangling/data/SAS_on_2021-04-13.csv'
## 2758 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data_wrangling/data/SAS_on_2021-04-13.csv'
## 2759 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data_wrangling/data/SAS_on_2021-04-13.csv'
## ....
## See problems(...) for more details.
```

Let's try to load it

```
problems(nchs)
```

```
## # A tibble: 88,128 × 5
```

##		row	col	expected	actual	file
##		<int>	<chr>	<chr>	<chr>	<chr>
##	1	2755	Year	1/0/T/F/TRUE/FALSE	2020	'/Users/kjhealy/Documents/courses/data...
##	2	2756	Year	1/0/T/F/TRUE/FALSE	2020	'/Users/kjhealy/Documents/courses/data...
##	3	2757	Year	1/0/T/F/TRUE/FALSE	2020	'/Users/kjhealy/Documents/courses/data...
##	4	2758	Year	1/0/T/F/TRUE/FALSE	2020	'/Users/kjhealy/Documents/courses/data...
##	5	2759	Year	1/0/T/F/TRUE/FALSE	2020	'/Users/kjhealy/Documents/courses/data...
##	6	2760	Year	1/0/T/F/TRUE/FALSE	2020	'/Users/kjhealy/Documents/courses/data...
##	7	2761	Year	1/0/T/F/TRUE/FALSE	2020	'/Users/kjhealy/Documents/courses/data...
##	8	2762	Year	1/0/T/F/TRUE/FALSE	2020	'/Users/kjhealy/Documents/courses/data...
##	9	2763	Year	1/0/T/F/TRUE/FALSE	2020	'/Users/kjhealy/Documents/courses/data...
##	10	2764	Year	1/0/T/F/TRUE/FALSE	2020	'/Users/kjhealy/Documents/courses/data...
##	#	...	with 88,118	more	rows	

Let's try to load it

```
problems(nchs)
```

```
## # A tibble: 88,128 × 5
##   row col expected actual file
##   <int> <chr> <chr>      <chr> <chr>
## 1  2755 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...'
## 2  2756 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...'
## 3  2757 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...'
## 4  2758 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...'
## 5  2759 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...'
## 6  2760 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...'
## 7  2761 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...'
## 8  2762 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...'
## 9  2763 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...'
## 10 2764 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...'
## # ... with 88,118 more rows
```

Problems are stored as an attribute of the `nchs` object, so we can revisit them.

Let's try to load it

```
problems(nchs)
```

```
## # A tibble: 88,128 × 5
```

```
##      row col   expected      actual file
```

```
##      <int> <chr> <chr>      <chr> <chr>
```

```
## 1  2755 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...
```

```
## 2  2756 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...
```

```
## 3  2757 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...
```

```
## 4  2758 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...
```

```
## 5  2759 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...
```

```
## 6  2760 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...
```

```
## 7  2761 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...
```

```
## 8  2762 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...
```

```
## 9  2763 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...
```

```
## 10 2764 Year 1/0/T/F/TRUE/FALSE 2020 '/Users/kjhealy/Documents/courses/data...
```

```
## # ... with 88,118 more rows
```

Problems are stored as an attribute of the `nchs` object, so we can revisit them.

Parsing failures tend to cascade. Our data only has 56k rows but we got 88k failures.

Take a look with **head()**

```
head(nchs)
```

```
## # A tibble: 6 × 16
##   `Data As Of` `Start Date` `End Date` Group   Year  Month State Sex   `Age Group`
##   <chr>        <chr>        <chr>    <chr>   <lgl> <lgl> <chr> <chr> <chr>
## 1 04/07/2021   01/01/2020   04/03/2021 By Total NA     NA    Unit... All ... All Ages
## 2 04/07/2021   01/01/2020   04/03/2021 By Total NA     NA    Unit... All ... Under 1 ye...
## 3 04/07/2021   01/01/2020   04/03/2021 By Total NA     NA    Unit... All ... 0-17 years
## 4 04/07/2021   01/01/2020   04/03/2021 By Total NA     NA    Unit... All ... 1-4 years
## 5 04/07/2021   01/01/2020   04/03/2021 By Total NA     NA    Unit... All ... 5-14 years
## 6 04/07/2021   01/01/2020   04/03/2021 By Total NA     NA    Unit... All ... 15-24 years
## # ... with 7 more variables: COVID-19 Deaths <dbl>, Total Deaths <dbl>,
## #   Pneumonia Deaths <dbl>, Pneumonia and COVID-19 Deaths <dbl>,
## #   Influenza Deaths <dbl>, Pneumonia, Influenza, or COVID-19 Deaths <dbl>,
## #   Footnote <chr>
```


Take a look with **tail()**

```
tail(nchs)
```

```
## # A tibble: 6 × 16
##   `Data As Of` `Start Date` `End Date` Group   Year  Month State Sex   `Age Group`
##   <chr>        <chr>        <chr>    <chr>   <lgl> <lgl> <chr> <chr> <chr>
## 1 04/07/2021   04/01/2021   04/03/2021 By Month NA     NA    Puer... Fema... 45-54 years
## 2 04/07/2021   04/01/2021   04/03/2021 By Month NA     NA    Puer... Fema... 50-64 years
## 3 04/07/2021   04/01/2021   04/03/2021 By Month NA     NA    Puer... Fema... 55-64 years
## 4 04/07/2021   04/01/2021   04/03/2021 By Month NA     NA    Puer... Fema... 65-74 years
## 5 04/07/2021   04/01/2021   04/03/2021 By Month NA     NA    Puer... Fema... 75-84 years
## 6 04/07/2021   04/01/2021   04/03/2021 By Month NA     NA    Puer... Fema... 85 years a...
## # ... with 7 more variables: COVID-19 Deaths <dbl>, Total Deaths <dbl>,
## #   Pneumonia Deaths <dbl>, Pneumonia and COVID-19 Deaths <dbl>,
## #   Influenza Deaths <dbl>, Pneumonia, Influenza, or COVID-19 Deaths <dbl>,
## #   Footnote <chr>
```

Take a look with `slice_sample()`

```
nchs %>%  
  slice_sample(n = 10)
```

```
## # A tibble: 10 × 16
```

```
##   `Data As Of` `Start Date` `End Date` Group   Year Month State      Sex  
##   <chr>        <chr>      <chr>    <chr>   <lgl> <lgl> <chr>    <chr>  
## 1 04/07/2021   02/01/2020   02/29/2020 By Month NA    NA    Missouri Male  
## 2 04/07/2021   07/01/2020   07/31/2020 By Month NA    NA    Iowa     All ...  
## 3 04/07/2021   09/01/2020   09/30/2020 By Month NA    NA    California Fema...  
## 4 04/07/2021   09/01/2020   09/30/2020 By Month NA    NA    Ohio     Male  
## 5 04/07/2021   08/01/2020   08/31/2020 By Month NA    NA    Oklahoma Fema...  
## 6 04/07/2021   01/01/2020   12/31/2020 By Year  NA    NA    South Dakota Fema...  
## 7 04/07/2021   10/01/2020   10/31/2020 By Month NA    NA    Wyoming  Male  
## 8 04/07/2021   09/01/2020   09/30/2020 By Month NA    NA    Hawaii    Fema...  
## 9 04/07/2021   01/01/2021   04/03/2021 By Year  NA    NA    California Male  
## 10 04/07/2021  08/01/2020   08/31/2020 By Month NA    NA    New Hampshire Male
```

```
## # ... with 8 more variables: Age Group <chr>, COVID-19 Deaths <dbl>,  
## #   Total Deaths <dbl>, Pneumonia Deaths <dbl>,  
## #   Pneumonia and COVID-19 Deaths <dbl>, Influenza Deaths <dbl>,  
## #   Pneumonia, Influenza, or COVID-19 Deaths <dbl>, Footnote <chr>
```

Aside: one that happened earlier ...

```
nchs %>%  
  slice_sample(n = 10)
```

```
## # A tibble: 10 x 16  
##   `Data As Of` `Start Date` `End Date` Group Year Month State Sex  
##   <chr>        <chr>        <chr>    <chr> <lg1> <lg1> <chr> <chr>  
## 1 04/07/2021  01/01/2020  04/03/2021 By Tot... NA    NA    Minnesota Male  
## 2 04/07/2021  02/01/2020  02/29/2020 By Mon... NA    NA    Georgia Male  
## 3 04/07/2021  02/01/2021  02/28/2021 By Mon... NA    NA    Maine Male  
## 4 04/07/2021  11/01/2020  11/30/2020 By Mon... NA    NA    New Jersey Female  
## 5 04/07/2021  01/01/2020  12/31/2020 By Year NA    NA    Rhode Island All Se...  
## 6 04/07/2021  01/01/2020  01/31/2020 By Mon... NA    TRUE   New York All Se...  
## 7 04/07/2021  05/01/2020  05/31/2020 By Mon... NA    NA    District of... Male  
## 8 04/07/2021  04/01/2021  04/03/2021 By Mon... NA    NA    North Carol... Female  
## 9 04/07/2021  03/01/2021  03/31/2021 By Mon... NA    NA    Kentucky Male  
## 10 04/07/2021  04/01/2021  04/03/2021 By Mon... NA    NA    New Mexico Female  
## # ... with 8 more variables: Age Group <chr>, COVID-19 Deaths <dbl>,  
## # Total Deaths <dbl>, Pneumonia Deaths <dbl>,  
## # Pneumonia and COVID-19 Deaths <dbl>, Influenza Deaths <dbl>,  
## # Pneumonia, Influenza, or COVID-19 Deaths <dbl>, Footnote <chr>
```

Take a look with `slice()`

Let's look at the rows `read_csv()` complained about.

```
nchs %>%  
  slice(2750:2760)
```

```
## # A tibble: 11 × 16
```

	'Data As Of'	'Start Date'	'End Date'	Group	Year	Month	State	Sex
	<chr>	<chr>	<chr>	<chr>	<lgl>	<lgl>	<chr>	<chr>
## 1	04/07/2021	01/01/2020	04/03/2021	By Total	NA	NA	Puerto Rico	Fema...
## 2	04/07/2021	01/01/2020	04/03/2021	By Total	NA	NA	Puerto Rico	Fema...
## 3	04/07/2021	01/01/2020	04/03/2021	By Total	NA	NA	Puerto Rico	Fema...
## 4	04/07/2021	01/01/2020	04/03/2021	By Total	NA	NA	Puerto Rico	Fema...
## 5	04/07/2021	01/01/2020	04/03/2021	By Total	NA	NA	Puerto Rico	Fema...
## 6	04/07/2021	01/01/2020	12/31/2020	By Year	NA	NA	United States	All ...
## 7	04/07/2021	01/01/2020	12/31/2020	By Year	NA	NA	United States	All ...
## 8	04/07/2021	01/01/2020	12/31/2020	By Year	NA	NA	United States	All ...
## 9	04/07/2021	01/01/2020	12/31/2020	By Year	NA	NA	United States	All ...
## 10	04/07/2021	01/01/2020	12/31/2020	By Year	NA	NA	United States	All ...
## 11	04/07/2021	01/01/2020	12/31/2020	By Year	NA	NA	United States	All ...

```
## # ... with 8 more variables: Age Group <chr>, COVID-19 Deaths <dbl>,
```

```
## #   Total Deaths <dbl>, Pneumonia Deaths <dbl>,
```

```
## #   Pneumonia and COVID-19 Deaths <dbl>, Influenza Deaths <dbl>,
```

```
## #   Pneumonia, Influenza, or COVID-19 Deaths <dbl>, Footnote <chr>
```

Take a look with `slice()`

```
nchs %>%  
  slice(2750:2760) %>%  
  select(Year, Month, State)
```

```
## # A tibble: 11 × 3  
##   Year Month State  
##   <lgl> <lgl> <chr>  
## 1 NA     NA     Puerto Rico  
## 2 NA     NA     Puerto Rico  
## 3 NA     NA     Puerto Rico  
## 4 NA     NA     Puerto Rico  
## 5 NA     NA     Puerto Rico  
## 6 NA     NA     United States  
## 7 NA     NA     United States  
## 8 NA     NA     United States  
## 9 NA     NA     United States  
## 10 NA    NA     United States  
## 11 NA    NA     United States
```

Hm, something to do with the transition to national numbers maybe?

Take a look with `select()` and `filter()`

```
nchs %>%  
  select(Year, Month, State) %>%  
  filter(State == "New York")
```

```
## # A tibble: 969 × 3  
##   Year Month State  
##   <lgl> <lgl> <chr>  
## 1 NA     NA     New York  
## 2 NA     NA     New York  
## 3 NA     NA     New York  
## 4 NA     NA     New York  
## 5 NA     NA     New York  
## 6 NA     NA     New York  
## 7 NA     NA     New York  
## 8 NA     NA     New York  
## 9 NA     NA     New York  
## 10 NA    NA     New York  
## # ... with 959 more rows
```

Take a look with `is.na()`

```
nchs %>%  
  select(Year, Month, State) %>%  
  filter(!is.na(Year))
```

```
## # A tibble: 0 × 3  
## # ... with 3 variables: Year <lgl>, Month <lgl>, State <chr>
```

It really has been read in as a completely empty column.

That doesn't seem like it can be right.

Take a look with **distinct()**

```
nchs %>%  
  select(Year) %>%  
  distinct(Year)
```

```
## # A tibble: 1 × 1  
##   Year  
##   <lgl>  
## 1 NA
```

Again, it's been read in as a completely empty column.

Take a look with `read_lines()`

Time to reach for a different kitchen knife.

```
read_lines(here("data", "SAS_on_2021-04-13.csv"), n_max = 10)
```

```
## [1] "Data As Of,Start Date,End Date,Group,Year,Month,State,Sex,Age Group,COVID-19 Deaths,Total Deaths,Pneumonia Death
## [2] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,All Ages,539723,4161167,466437,263147,9037,7
## [3] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,Under 1 year,59,22626,246,10,21,316,"
## [4] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,0-17 years,251,39620,667,46,179,1051,"
## [5] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,1-4 years,31,4069,137,5,61,224,"
## [6] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,5-14 years,89,6578,195,19,76,341,"
## [7] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,15-24 years,804,42596,930,317,81,1493,"
## [8] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,18-29 years,1996,75339,2184,884,150,3434,"
## [9] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,25-34 years,3543,88196,3493,1617,237,5638,"
## [10] "04/07/2021,01/01/2020,04/03/2021,By Total,,,United States,All Sexes,30-39 years,5792,107348,5276,2658,318,8706,"
```

We can get the whole thing this way

```
raw_file <- read_lines(here("data", "SAS_on_2021-04-13.csv"))
```

This imports the data as a long, long character vector, with each element being a line.

```
# reminder: indexing 1D vectors  
letters[5:6]
```

```
## [1] "e" "f"
```

Now we're just looking at lines in a file

```
# This is not a tibble; we have to index it the basic way  
raw_file[2753:2758]
```

```
## [1] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,65-74 years,203,2650,410,151,,466,One or more data  
## [2] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,75-84 years,234,4274,656,154,16,751,"  
## [3] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,85 years and over,222,6164,795,136,29,909,"  
## [4] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,All Ages,380949,3372967,349667,178222,8779  
## [5] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,Under 1 year,48,19356,224,9,21,284,"  
## [6] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,0-17 years,189,33808,598,35,178,930,"
```

Now we're just looking at lines in a file

```
# This is not a tibble; we have to index it the basic way  
raw_file[2753:2758]
```

```
## [1] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,65-74 years,203,2650,410,151,,466,One or more data  
## [2] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,75-84 years,234,4274,656,154,16,751,"  
## [3] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,85 years and over,222,6164,795,136,29,909,"  
## [4] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,All Ages,380949,3372967,349667,178222,8779  
## [5] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,Under 1 year,48,19356,224,9,21,284,"  
## [6] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,0-17 years,189,33808,598,35,178,930,"
```

There you are, you little bastard.

Now we're just looking at lines in a file

```
# This is not a tibble; we have to index it the basic way  
raw_file[2753:2758]
```

```
### [1] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,65-74 years,203,2650,410,151,,466,One or more data  
### [2] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,75-84 years,234,4274,656,154,16,751,"  
### [3] "04/07/2021,01/01/2020,04/03/2021,By Total,,,Puerto Rico,Female,85 years and over,222,6164,795,136,29,909,"  
### [4] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,All Ages,380949,3372967,349667,178222,8779  
### [5] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,Under 1 year,48,19356,224,9,21,284,"  
### [6] "04/07/2021,01/01/2020,12/31/2020,By Year,2020,,United States,All Sexes,0-17 years,189,33808,598,35,178,930,"
```

There you are, you little bastard.

In this case, this is due to the kind of data this is, mixing multiple reporting levels and totals. That is, it's not a mistake in the *data*, but rather in the *parsing*.

OK, let's go back to the colspec!

```
nchs <- with_edition(1, read_csv(here("data", "SAS_on_2021-04-13.csv")))
```

```
##  
## — Column specification —————  
## cols(  
##   `Data As Of` = col_character(),  
##   `Start Date` = col_character(),  
##   `End Date` = col_character(),  
##   Group = col_character(),  
##   Year = col_logical(),  
##   Month = col_logical(),  
##   State = col_character(),  
##   Sex = col_character(),  
##   `Age Group` = col_character(),  
##   `COVID-19 Deaths` = col_double(),  
##   `Total Deaths` = col_double(),  
##   `Pneumonia Deaths` = col_double(),  
##   `Pneumonia and COVID-19 Deaths` = col_double(),  
##   `Influenza Deaths` = col_double(),  
##   `Pneumonia, Influenza, or COVID-19 Deaths` = col_double(),  
##   Footnote = col_character()  
## )
```

We can just copy it from the console output! It's valid code.

We use it with **col_types**

```
nchs <- with_edition(1, read_csv(here("data", "SAS_on_2021-04-13.csv"),
  col_types = cols(
    `Data As Of` = col_character(),
    `Start Date` = col_character(),
    `End Date` = col_character(),
    Group = col_character(),
    Year = col_logical(),
    Month = col_logical(),
    State = col_character(),
    Sex = col_character(),
    `Age Group` = col_character(),
    `COVID-19 Deaths` = col_double(),
    `Total Deaths` = col_double(),
    `Pneumonia Deaths` = col_double(),
    `Pneumonia and COVID-19 Deaths` = col_double(),
    `Influenza Deaths` = col_double(),
    `Pneumonia, Influenza, or COVID-19 Deaths` = col_double(),
    Footnote = col_character()
  )))
```

But we know we need to make some adjustments.

Fixes

```
# Date format
us_style <- "%m/%d/%Y"

nchs <- with_edition(1, read_csv(
  here("data", "SAS_on_2021-04-13.csv"),
  col_types = cols(
    `Data As Of` = col_date(format = us_style),
    `Start Date` = col_date(format = us_style),
    `End Date` = col_date(format = us_style),
    Group = col_character(),
    Year = col_character(),
    Month = col_character(),
    State = col_character(),
    Sex = col_character(),
    `Age Group` = col_character(),
    `COVID-19 Deaths` = col_integer(),
    `Total Deaths` = col_integer(),
    `Pneumonia Deaths` = col_integer(),
    `Pneumonia and COVID-19 Deaths` = col_integer(),
    `Influenza Deaths` = col_integer(),
    `Pneumonia, Influenza, or COVID-19 Deaths` = col_integer(),
    Footnote = col_character()
  )) %>%
  janitor::clean_names() %>%
  select(-footnote) %>%
  mutate(age_group = stringr::str_to_sentence(age_group)) %>%
  filter(!stringr::str_detect(state, "Total"))
)
```


Now let's look again

```
dim(nchs)
```

```
## [1] 52326    15
```

```
nchs %>%  
  select(year, month, state) %>%  
  filter(!is.na(year))
```

```
## # A tibble: 49,572 × 3  
##   year month state  
##   <chr> <chr> <chr>  
## 1 2020  <NA>  United States  
## 2 2020  <NA>  United States  
## 3 2020  <NA>  United States  
## 4 2020  <NA>  United States  
## 5 2020  <NA>  United States  
## 6 2020  <NA>  United States  
## 7 2020  <NA>  United States  
## 8 2020  <NA>  United States  
## 9 2020  <NA>  United States  
## 10 2020  <NA>  United States  
## # ... with 49,562 more rows
```

Now let's look again

```
nchs %>%  
  distinct(year)
```

```
## # A tibble: 3 × 1  
##   year  
##   <chr>  
## 1 <NA>  
## 2 2020  
## 3 2021
```

Lessons learned

Lessons learned

I said at the start that it was no fun, but also weirdly satisfying.

Lessons learned

I said at the start that it was no fun, but also weirdly satisfying.

When `read_csv()` warns you of a parsing failure *don't ignore it*.

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I said at the start that it was no fun, but also weirdly satisfying.

When `read_csv()` warns you of a parsing failure *don't ignore it*.

`read_lines()` lets you get the file in a nearly unprocessed form.

Lessons learned

I said at the start that it was no fun, but also weirdly satisfying.

When `read_csv()` warns you of a parsing failure *don't ignore it*.

`read_lines()` lets you get the file in a nearly unprocessed form.

The `colspec` output is your friend.

If we wanted to ...

```
library(stringr) # it's back!
```


If we wanted to ...

```
library(stringr) # it's back!
```

```
nchs
```

```
## # A tibble: 52,326 × 15
##   data_as_of start_date end_date   group   year month state  sex  ag
##   <date>      <date>   <date>   <chr>   <chr> <chr> <chr> <chr> <chr>
## 1 2021-04-07 2020-01-01 2021-04-03 By Total <NA> <NA> United... All ... AL
## 2 2021-04-07 2020-01-01 2021-04-03 By Total <NA> <NA> United... All ... Un
## 3 2021-04-07 2020-01-01 2021-04-03 By Total <NA> <NA> United... All ... 0-
## 4 2021-04-07 2020-01-01 2021-04-03 By Total <NA> <NA> United... All ... 1-
## 5 2021-04-07 2020-01-01 2021-04-03 By Total <NA> <NA> United... All ... 5-
## 6 2021-04-07 2020-01-01 2021-04-03 By Total <NA> <NA> United... All ... 15
## 7 2021-04-07 2020-01-01 2021-04-03 By Total <NA> <NA> United... All ... 18
## 8 2021-04-07 2020-01-01 2021-04-03 By Total <NA> <NA> United... All ... 25
## 9 2021-04-07 2020-01-01 2021-04-03 By Total <NA> <NA> United... All ... 30
## 10 2021-04-07 2020-01-01 2021-04-03 By Total <NA> <NA> United... All ... 35
## # ... with 52,316 more rows, and 6 more variables: covid_19_deaths <int>,
## #   total_deaths <int>, pneumonia_deaths <int>,
## #   pneumonia_and_covid_19_deaths <int>, influenza_deaths <int>,
## #   pneumonia_influenza_or_covid_19_deaths <int>
```

If we wanted to ...

```
library(stringr) # it's back!
```

```
nchs %>%
```

```
  select(!(c(data_as_of:end_date, year, month)))
```

```
## # A tibble: 52,326 × 10
```

```
##   group      state      sex      age_group covid_19_deaths total_deaths
```

```
##   <chr>      <chr>      <chr>      <chr>          <int>          <int>
```

```
## 1 By Total United States All Sexes All ages          539723        416116
```

```
## 2 By Total United States All Sexes Under 1 ...           59           2262
```

```
## 3 By Total United States All Sexes 0-17 yea...          251          3962
```

```
## 4 By Total United States All Sexes 1-4 years            31           406
```

```
## 5 By Total United States All Sexes 5-14 yea...           89           657
```

```
## 6 By Total United States All Sexes 15-24 ye...          804          4259
```

```
## 7 By Total United States All Sexes 18-29 ye...         1996          7533
```

```
## 8 By Total United States All Sexes 25-34 ye...         3543          8819
```

```
## 9 By Total United States All Sexes 30-39 ye...         5792         10734
```

```
## 10 By Total United States All Sexes 35-44 ye...         9259         12684
```

```
## # ... with 52,316 more rows, and 3 more variables:
```

```
## #   pneumonia_and_covid_19_deaths <int>, influenza_deaths <int>,
```

```
## #   pneumonia_influenza_or_covid_19_deaths <int>
```

If we wanted to ...

```
library(stringr) # it's back!
```

```
nchs %>%
```

```
  select(!(c(data_as_of:end_date, year, month))) %>%
```

```
  pivot_longer(covid_19_deaths:pneumonia_influenza_or_covid_19_deaths,  
               names_to = "outcome",  
               values_to = "n")
```

```
## # A tibble: 313,956 × 6
```

```
##   group      state      sex      age_group outcome
```

```
##   <chr>      <chr>      <chr>      <chr>      <chr>
```

```
## 1 By Total United States All Sexes All ages covid_19_deaths
```

```
## 2 By Total United States All Sexes All ages total_deaths
```

```
## 3 By Total United States All Sexes All ages pneumonia_deaths
```

```
## 4 By Total United States All Sexes All ages pneumonia_and_covid_19_...
```

```
## 5 By Total United States All Sexes All ages influenza_deaths
```

```
## 6 By Total United States All Sexes All ages pneumonia_influenza_or_...
```

```
## 7 By Total United States All Sexes Under 1 year covid_19_deaths
```

```
## 8 By Total United States All Sexes Under 1 year total_deaths
```

```
## 9 By Total United States All Sexes Under 1 year pneumonia_deaths
```

```
## 10 By Total United States All Sexes Under 1 year pneumonia_and_covid_19_...
```

```
## # ... with 313,946 more rows
```

If we wanted to ...

```
library(stringr) # it's back!

nchs %>%
  select(!(c(data_as_of:end_date, year, month))) %>%
  pivot_longer(covid_19_deaths:pneumonia_influenza_or_covid_19_deaths,
    names_to = "outcome",
    values_to = "n") %>%
  mutate(outcome = str_to_sentence(outcome),
    outcome = str_replace_all(outcome, "_", " "),
    outcome = str_replace(outcome, "(C|c)ovid 19", "COVID-19"))
```

```
## # A tibble: 313,956 × 6
```

```
##   group      state      sex      age_group      outcome
##   <chr>    <chr>    <chr>    <chr>    <chr>
## 1 By Total United States All Sexes All ages COVID-19 deaths
## 2 By Total United States All Sexes All ages Total deaths
## 3 By Total United States All Sexes All ages Pneumonia deaths
## 4 By Total United States All Sexes All ages Pneumonia and COVID-19 ...
## 5 By Total United States All Sexes All ages Influenza deaths
## 6 By Total United States All Sexes All ages Pneumonia influenza or ...
## 7 By Total United States All Sexes Under 1 year COVID-19 deaths
## 8 By Total United States All Sexes Under 1 year Total deaths
## 9 By Total United States All Sexes Under 1 year Pneumonia deaths
## 10 By Total United States All Sexes Under 1 year Pneumonia and COVID-19 ...
## # ... with 313,946 more rows
```

If we wanted to ...

```
library(stringr) # it's back!

nchs %>%
  select(!(c(data_as_of:end_date, year, month))) %>%
  pivot_longer(covid_19_deaths:pneumonia_influenza_or_covid_19_deaths,
    names_to = "outcome",
    values_to = "n") %>%
  mutate(outcome = str_to_sentence(outcome),
    outcome = str_replace_all(outcome, "_", " "),
    outcome = str_replace(outcome, "(C|c)ovid 19", "COVID-19"))
```

```
## # A tibble: 313,956 × 6
##   group state sex age_group outcome
##   <chr> <chr> <chr> <chr> <chr>
## 1 By Total United States All Sexes All ages COVID-19 deaths
## 2 By Total United States All Sexes All ages Total deaths
## 3 By Total United States All Sexes All ages Pneumonia deaths
## 4 By Total United States All Sexes All ages Pneumonia and COVID-19 ...
## 5 By Total United States All Sexes All ages Influenza deaths
## 6 By Total United States All Sexes All ages Pneumonia influenza or ...
## 7 By Total United States All Sexes Under 1 year COVID-19 deaths
## 8 By Total United States All Sexes Under 1 year Total deaths
## 9 By Total United States All Sexes Under 1 year Pneumonia deaths
## 10 By Total United States All Sexes Under 1 year Pneumonia and COVID-19 ...
## # ... with 313,946 more rows
```

Put this in `nchs_fmt`

... we could make a table or graph

```
nchs_fmt %>%  
  select(state, age_group, outcome, n)
```

```
## # A tibble: 313,956 × 4  
##   state      age_group outcome                n  
##   <chr>      <chr>    <chr>                <int>  
## 1 United States All ages COVID-19 deaths      539723  
## 2 United States All ages Total deaths        4161167  
## 3 United States All ages Pneumonia deaths    466437  
## 4 United States All ages Pneumonia and COVID-19 deaths 263147  
## 5 United States All ages Influenza deaths        9037  
## 6 United States All ages Pneumonia influenza or COVID-19 deaths 750804  
## 7 United States Under 1 year COVID-19 deaths        59  
## 8 United States Under 1 year Total deaths        22626  
## 9 United States Under 1 year Pneumonia deaths        246  
## 10 United States Under 1 year Pneumonia and COVID-19 deaths    10  
## # ... with 313,946 more rows
```

Cleaned up (but not tidy)

```
nchs_fmt %>%  
  distinct(group)
```

```
## # A tibble: 3 × 1  
##   group  
##   <chr>  
## 1 By Total  
## 2 By Year  
## 3 By Month
```

Cleaned up (but not tidy)

```
nchs_fmt %>%  
  distinct(group)
```

```
## # A tibble: 3 × 1  
##   group  
##   <chr>  
## 1 By Total  
## 2 By Year  
## 3 By Month
```

```
nchs_fmt %>%  
  distinct(age_group)
```

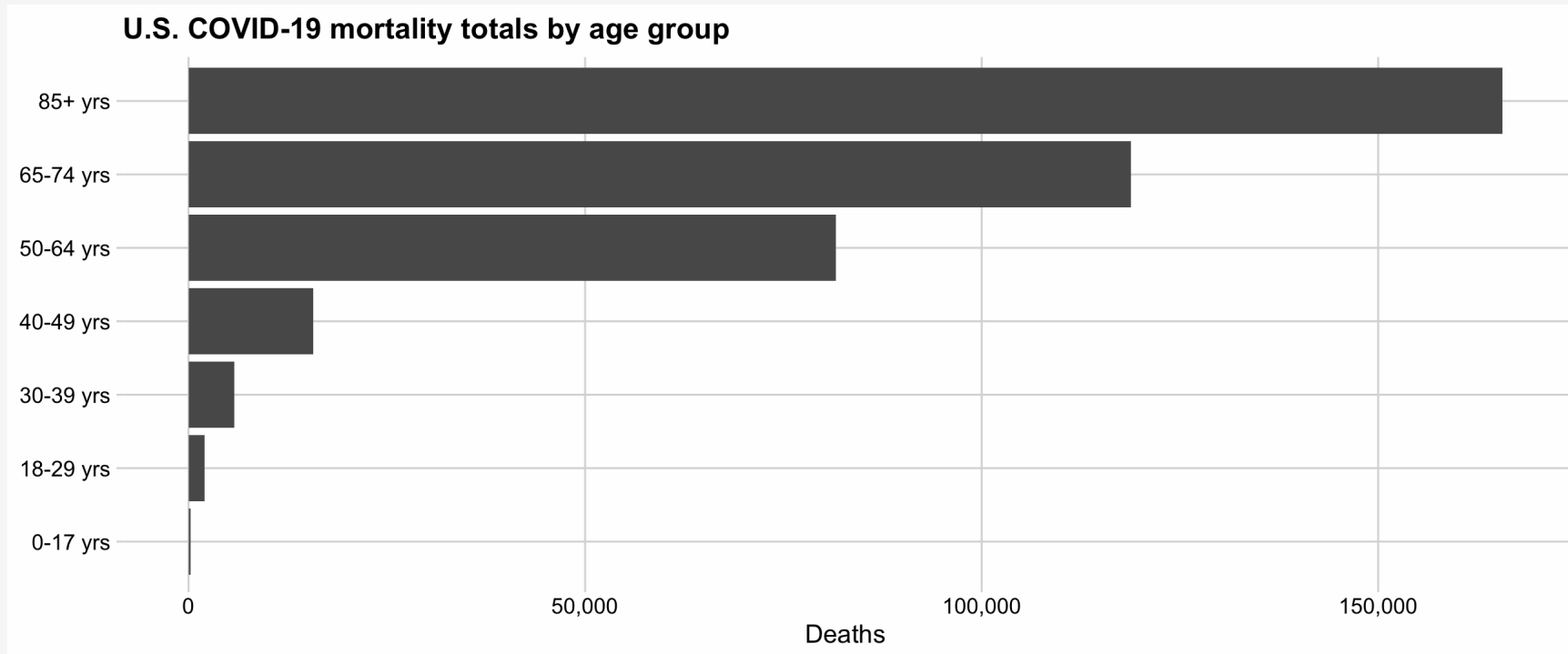
```
## # A tibble: 17 × 1  
##   age_group  
##   <chr>  
## 1 All ages  
## 2 Under 1 year  
## 3 0-17 years  
## 4 1-4 years  
## 5 5-14 years  
## 6 15-24 years  
## 7 18-29 years  
## 8 25-34 years  
## 9 30-39 years  
## 10 35-44 years  
## 11 40-49 years  
## 12 45-54 years  
## 13 50-64 years  
## 14 55-64 years  
## 15 65-74 years  
## 16 75-84 years  
## 17 85 years and over
```


Make our plot

```
p_out <- nchs_fmt %>%
  filter(group %in% "By Total",
         sex %in% "All Sexes",
         state %in% "United States",
         age_group %in% c("0-17 years",
                          "18-29 years",
                          "30-39 years",
                          "40-49 years",
                          "50-64 years",
                          "65-74 years",
                          "85 years and over"),
         outcome %in% "COVID-19 deaths") %>%
  mutate(age_group = str_replace(age_group, "years", "yrs"),
         age_group = str_replace(age_group, " and over", ""),
         age_group = str_replace(age_group, "85", "85+")) %>%
  ggplot(mapping = aes(x = n, y = age_group)) +
  geom_col() + scale_x_continuous(labels = scales::comma) +
  labs(x = "Deaths", y = NULL, title = "U.S. COVID-19 mortality totals by age group")
```

Result

```
print(p_out)
```



Every
dataset is
different

Dropping missing values: a quick demo

```
df <- tribble(  
  ~a, ~b, ~c,  
  1, NA, 2,  
  NA, NA, NA,  
  2, 2, 2  
)  
df
```

```
## # A tibble: 3 × 3  
##       a     b     c  
##   <dbl> <dbl> <dbl>  
## 1     1    NA     2  
## 2    NA    NA    NA  
## 3     2     2     2
```

Dropping **missing values**: a quick demo

```
# 1 Write it yourself
df %>%
  filter(complete.cases(.))
```

```
## # A tibble: 1 × 3
##       a       b       c
##   <dbl> <dbl> <dbl>
## 1     2     2     2
```

```
# 2 Convenience function
df %>%
  drop_na()
```

```
## # A tibble: 1 × 3
##       a       b       c
##   <dbl> <dbl> <dbl>
## 1     2     2     2
```

Both drop all rows with *any* missing cases.

Dropping **missing values**: a quick demo

What if we only want to drop all rows with *all* missing cases?

```
# 3  
df %>%  
  filter(!(is.na(.))) # Pronoun
```

```
## # A tibble: 2 × 3  
##       a      b      c  
##   <dbl> <dbl> <dbl>  
## 1     1    NA     2  
## 2     2     2     2
```

Read `.` as "the thing we're looking at" or "the thing we're computing on right now".

Cleaning a table

With that in mind ... Some marketing data

SEGMENT	DESCRIPTION	R	F	M
Champions	Bought recently, buy often and spend the most	4- 5	4- 5	4- 5
Loyal Customers	Spend good money. Responsive to promotions	2- 5	3- 5	3- 5
Potential Loyalist	Recent customers, spent good amount, bought more than once	3- 5	1- 3	1- 3
New Customers	Bought more recently, but not often	4- 5	<= 1	<= 1
Promising	Recent shoppers, but haven't spent much	3- 4	<= 1	<= 1
Need Attention	Above average recency, frequency & monetary values	2- 3	2- 3	2- 3
About To Sleep	Below average recency, frequency & monetary values	2- 3	<= 2	<= 2
At Risk	Spent big money, purchased often but long time ago	<= 2	2- 5	2- 5
Can't Lose Them	Made big purchases and often, but long time ago	<= 1	4- 5	4- 5
Hibernating	Low spenders, low frequency, purchased long time ago	1- 2	1- 2	1- 2
Lost	Lowest recency, frequency & monetary scores	<= 2	<= 2	<= 2

Cleaning a table

```
read_csv(here("data", "rfm_table.csv"))
```

```
## # A tibble: 23 × 5
##   SEGMENT DESCRIPTION R F M
##   <chr> <chr> <chr> <chr> <chr>
## 1 <NA> <NA> <NA> <NA> <NA>
## 2 Champions Bought recently, buy often and spend th... 4- 5 4- 5 4- 5
## 3 <NA> <NA> <NA> <NA> <NA>
## 4 Loyal Customers Spend good money. Responsive to promoti... 2- 5 3- 5 3- 5
## 5 <NA> <NA> <NA> <NA> <NA>
## 6 Potential Loyalist Recent customers, spent good amount, bo... 3- 5 1- 3 1- 3
## 7 <NA> <NA> <NA> <NA> <NA>
## 8 New Customers Bought more recently, but not often 4- 5 <= 1 <= 1
## 9 <NA> <NA> <NA> <NA> <NA>
## 10 Promising Recent shoppers, but haven't spent much 3- 4 <= 1 <= 1
## # ... with 13 more rows
```


Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%  
  janitor::clean_names()
```

```
## # A tibble: 23 × 5  
##   segment      description      r      f      m  
##   <chr>      <chr>      <chr> <chr> <chr>  
## 1 <NA>      <NA>      <NA> <NA> <NA>  
## 2 Champions Bought recently, buy often and spend th... 4- 5 4- 5 4- 5  
## 3 <NA>      <NA>      <NA> <NA> <NA>  
## 4 Loyal Customers Spend good money. Responsive to promoti... 2- 5 3- 5 3- 5  
## 5 <NA>      <NA>      <NA> <NA> <NA>  
## 6 Potential Loyalist Recent customers, spent good amount, bo... 3- 5 1- 3 1- 3  
## 7 <NA>      <NA>      <NA> <NA> <NA>  
## 8 New Customers Bought more recently, but not often      4- 5 <= 1 <= 1  
## 9 <NA>      <NA>      <NA> <NA> <NA>  
## 10 Promising Recent shoppers, but haven't spent much 3- 4 <= 1 <= 1  
## # ... with 13 more rows
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%  
  janitor::clean_names() %>%  
  filter(!(is.na(.))) #<<
```

```
## # A tibble: 11 × 5  
##   segment      description      r      f      m  
##   <chr>      <chr>      <chr> <chr> <chr>  
## 1 Champions Bought recently, buy often and spend th... 4- 5 4- 5 4- 5  
## 2 Loyal Customers Spend good money. Responsive to promoti... 2- 5 3- 5 3- 5  
## 3 Potential Loyalist Recent customers, spent good amount, bo... 3- 5 1- 3 1- 3  
## 4 New Customers Bought more recently, but not often      4- 5 <= 1 <= 1  
## 5 Promising Recent shoppers, but haven't spent much 3- 4 <= 1 <= 1  
## 6 Need Attention Above average recency, frequency & mone... 2- 3 2- 3 2- 3  
## 7 About To Sleep Below average recency, frequency & mone... 2- 3 <= 2 <= 2  
## 8 At Risk Spent big money, purchased often but lo... <= 2 2- 5 2- 5  
## 9 Can't Lose Them Made big purchases and often, but long ... <= 1 4- 5 4- 5  
## 10 Hibernating Low spenders, low frequency, purchased ... 1- 2 1- 2 1- 2  
## 11 Lost Lowest recency, frequency & monetary sc... <= 2 <= 2 <= 2
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%  
  janitor::clean_names() %>%  
  filter(!(is.na(.))) %>%  
  pivot_longer(cols = r:m)
```

```
## # A tibble: 33 × 4  
##   segment      description name value  
##   <chr>      <chr>      <chr> <chr>  
## 1 Champions Bought recently, buy often and spend the most r 4- 5  
## 2 Champions Bought recently, buy often and spend the most f 4- 5  
## 3 Champions Bought recently, buy often and spend the most m 4- 5  
## 4 Loyal Customers Spend good money. Responsive to promotions r 2- 5  
## 5 Loyal Customers Spend good money. Responsive to promotions f 3- 5  
## 6 Loyal Customers Spend good money. Responsive to promotions m 3- 5  
## 7 Potential Loyalist Recent customers, spent good amount, bought m... r 3- 5  
## 8 Potential Loyalist Recent customers, spent good amount, bought m... f 1- 3  
## 9 Potential Loyalist Recent customers, spent good amount, bought m... m 1- 3  
## 10 New Customers Bought more recently, but not often r 4- 5  
## # ... with 23 more rows
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%
  janitor::clean_names() %>%
  filter(!(is.na(.))) %>%
  pivot_longer(cols = r:m) %>%
  separate(col = value, into = c("lo", "hi"),
           remove = FALSE, convert = TRUE,
           fill = "left")
```

```
## # A tibble: 33 × 6
##   segment      description name value lo hi
##   <chr>      <chr>      <chr> <chr> <int> <int>
## 1 Champions Bought recently, buy often and sp... r    4- 5    4    5
## 2 Champions Bought recently, buy often and sp... f    4- 5    4    5
## 3 Champions Bought recently, buy often and sp... m    4- 5    4    5
## 4 Loyal Customers Spend good money. Responsive to p... r    2- 5    2    5
## 5 Loyal Customers Spend good money. Responsive to p... f    3- 5    3    5
## 6 Loyal Customers Spend good money. Responsive to p... m    3- 5    3    5
## 7 Potential Loyalist Recent customers, spent good amou... r    3- 5    3    5
## 8 Potential Loyalist Recent customers, spent good amou... f    1- 3    1    3
## 9 Potential Loyalist Recent customers, spent good amou... m    1- 3    1    3
## 10 New Customers Bought more recently, but not oft... r    4- 5    4    5
## # ... with 23 more rows
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%
  janitor::clean_names() %>%
  filter(!is.na(.)) %>%
  pivot_longer(cols = r:m) %>%
  separate(col = value, into = c("lo", "hi"),
           remove = FALSE, convert = TRUE,
           fill = "left") %>%
  select(-value)
```

```
## # A tibble: 33 × 5
##   segment      description name      lo      hi
##   <chr>      <chr>      <chr> <int> <int>
## 1 Champions Bought recently, buy often and spend th... r      4      5
## 2 Champions Bought recently, buy often and spend th... f      4      5
## 3 Champions Bought recently, buy often and spend th... m      4      5
## 4 Loyal Customers Spend good money. Responsive to promoti... r      2      5
## 5 Loyal Customers Spend good money. Responsive to promoti... f      3      5
## 6 Loyal Customers Spend good money. Responsive to promoti... m      3      5
## 7 Potential Loyalist Recent customers, spent good amount, bo... r      3      5
## 8 Potential Loyalist Recent customers, spent good amount, bo... f      1      3
## 9 Potential Loyalist Recent customers, spent good amount, bo... m      1      3
## 10 New Customers Bought more recently, but not often      r      4      5
## # ... with 23 more rows
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%
  janitor::clean_names() %>%
  filter(!(is.na(.))) %>%
  pivot_longer(cols = r:m) %>%
  separate(col = value, into = c("lo", "hi"),
           remove = FALSE, convert = TRUE,
           fill = "left") %>%
  select(-value) %>%
  pivot_wider(names_from = name,
             values_from = lo:hi)
```

```
## # A tibble: 11 × 8
##   segment      description lo_r lo_f lo_m hi_r hi_f hi_m
##   <chr>      <chr>      <int> <int> <int> <int> <int> <int>
## 1 Champions Bought recently, buy ...     4     4     4     5     5     5
## 2 Loyal Customers Spend good money. Res...     2     3     3     5     5     5
## 3 Potential Loyalist Recent customers, spe...     3     1     1     5     3     3
## 4 New Customers Bought more recently,...     4    NA    NA     5     1     1
## 5 Promising Recent shoppers, but ...     3    NA    NA     4     1     1
## 6 Need Attention Above average recency...     2     2     2     3     3     3
## 7 About To Sleep Below average recency...     2    NA    NA     3     2     2
## 8 At Risk Spent big money, purc...    NA     2     2     2     5     5
## 9 Can't Lose Them Made big purchases an...    NA     4     4     1     5     5
## 10 Hibernating Low spenders, low fre...     1     1     1     2     2     2
## 11 Lost Lowest recency, frequ...    NA    NA    NA     2     2     2
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%
  janitor::clean_names() %>%
  filter(!is.na(.)) %>%
  pivot_longer(cols = r:m) %>%
  separate(col = value, into = c("lo", "hi"),
           remove = FALSE, convert = TRUE,
           fill = "left") %>%
  select(-value) %>%
  pivot_wider(names_from = name,
             values_from = lo:hi) %>%
  mutate_if(is.integer, replace_na, 0)
```

```
## # A tibble: 11 × 8
##   segment      description lo_r lo_f lo_m hi_r hi_f hi_m
##   <chr>      <chr>      <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1 Champions Bought recently, buy ...     4     4     4     5     5     5
## 2 Loyal Customers Spend good money. Res...     2     3     3     5     5     5
## 3 Potential Loyalist Recent customers, spe...     3     1     1     5     3     3
## 4 New Customers Bought more recently,...     4     0     0     5     1     1
## 5 Promising Recent shoppers, but ...     3     0     0     4     1     1
## 6 Need Attention Above average recency...     2     2     2     3     3     3
## 7 About To Sleep Below average recency...     2     0     0     3     2     2
## 8 At Risk Spent big money, purc...     0     2     2     2     5     5
## 9 Can't Lose Them Made big purchases an...     0     4     4     1     5     5
## 10 Hibernating Low spenders, low fre...     1     1     1     2     2     2
## 11 Lost Lowest recency, frequ...
```

Cleaning a table

```
read_csv(here("data", "rfm_table.csv")) %>%
  janitor::clean_names() %>%
  filter(!is.na(.)) %>%
  pivot_longer(cols = r:m) %>%
  separate(col = value, into = c("lo", "hi"),
           remove = FALSE, convert = TRUE,
           fill = "left") %>%
  select(-value) %>%
  pivot_wider(names_from = name,
             values_from = lo:hi) %>%
  mutate_if(is.integer, replace_na, 0) %>%
  select(segment,
         lo_r, hi_r,
         lo_f, hi_f,
         lo_m, hi_m,
         description)
```

```
## # A tibble: 11 × 8
##   segment      lo_r hi_r lo_f hi_f lo_m hi_m description
##   <chr>      <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <chr>
## 1 Champions         4     5     4     5     4     5 Bought recently, buy ...
## 2 Loyal Customers    2     5     3     5     3     5 Spend good money. Res...
## 3 Potential Loyalist 3     5     1     3     1     3 Recent customers, spe...
## 4 New Customers      4     5     0     1     0     1 Bought more recently,...
## 5 Promising          3     4     0     1     0     1 Recent shoppers, but ...
## 6 Need Attention     2     3     2     3     2     3 Above average recency...
## 7 About To Sleep     2     3     0     2     0     2 Below average recency...
## 8 At Risk            0     2     2     5     2     5 Spent big money, purc...
## 9 Can't Lose Them    0     1     4     5     4     5 Made big purchases an...
## 10 Hibernating        1     2     1     2     1     2 Low spenders, low fre...
## 11 Lost              0     2     0     2     0     2 Lowest recency, frequ...
```


Maybe a candidate for **rowwise**?

```
rfm_table
```

```
## # A tibble: 11 × 8
```

##	segment	lo_r	hi_r	lo_f	hi_f	lo_m	hi_m	description
##	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<chr>
##	1 Champions	4	5	4	5	4	5	Bought recently, buy ...
##	2 Loyal Customers	2	5	3	5	3	5	Spend good money. Res...
##	3 Potential Loyalist	3	5	1	3	1	3	Recent customers, spe...
##	4 New Customers	4	5	0	1	0	1	Bought more recently,...
##	5 Promising	3	4	0	1	0	1	Recent shoppers, but ...
##	6 Need Attention	2	3	2	3	2	3	Above average recency...
##	7 About To Sleep	2	3	0	2	0	2	Below average recency...
##	8 At Risk	0	2	2	5	2	5	Spent big money, purc...
##	9 Can't Lose Them	0	1	4	5	4	5	Made big purchases an...
##	10 Hibernating	1	2	1	2	1	2	Low spenders, low fre...
##	11 Lost	0	2	0	2	0	2	Lowest recency, frequ...

Maybe a candidate for **rowwise**?

This does what we expect:

```
rfm_table %>%  
  mutate(sum_lo = lo_r + lo_f + lo_m,  
         sum_hi = hi_r + hi_f + hi_m) %>%  
  select(segment, sum_lo, sum_hi, everything())
```

```
## # A tibble: 11 × 10
```

##	segment	sum_lo	sum_hi	lo_r	hi_r	lo_f	hi_f	lo_m	hi_m	description
##	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<chr>
##	1 Champions	12	15	4	5	4	5	4	5	Bought rec...
##	2 Loyal Customers	8	15	2	5	3	5	3	5	Spend good...
##	3 Potential Loyalist	5	11	3	5	1	3	1	3	Recent cus...
##	4 New Customers	4	7	4	5	0	1	0	1	Bought mor...
##	5 Promising	3	6	3	4	0	1	0	1	Recent sho...
##	6 Need Attention	6	9	2	3	2	3	2	3	Above aver...
##	7 About To Sleep	2	7	2	3	0	2	0	2	Below aver...
##	8 At Risk	4	12	0	2	2	5	2	5	Spent big ...
##	9 Can't Lose Them	8	11	0	1	4	5	4	5	Made big p...
##	10 Hibernating	3	6	1	2	1	2	1	2	Low spende...
##	11 Lost	0	6	0	2	0	2	0	2	Lowest rec...

This adds each column, elementwise.

Maybe a candidate for **rowwise**?

But this does not:

```
rfm_table %>%  
  mutate(sum_lo = sum(lo_r, lo_f, lo_m),  
         sum_hi = sum(hi_r, hi_f, hi_m)) %>%  
  select(segment, sum_lo, sum_hi, everything())
```

```
## # A tibble: 11 × 10
```

##	segment	sum_lo	sum_hi	lo_r	hi_r	lo_f	hi_f	lo_m	hi_m	description
##	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<chr>
##	1 Champions	55	105	4	5	4	5	4	5	Bought rec...
##	2 Loyal Customers	55	105	2	5	3	5	3	5	Spend good...
##	3 Potential Loyalist	55	105	3	5	1	3	1	3	Recent cus...
##	4 New Customers	55	105	4	5	0	1	0	1	Bought mor...
##	5 Promising	55	105	3	4	0	1	0	1	Recent sho...
##	6 Need Attention	55	105	2	3	2	3	2	3	Above aver...
##	7 About To Sleep	55	105	2	3	0	2	0	2	Below aver...
##	8 At Risk	55	105	0	2	2	5	2	5	Spent big ...
##	9 Can't Lose Them	55	105	0	1	4	5	4	5	Made big p...
##	10 Hibernating	55	105	1	2	1	2	1	2	Low spende...
##	11 Lost	55	105	0	2	0	2	0	2	Lowest rec...

Sum is taking all the columns, adding them up (into a single number), and putting that result in each row.

Maybe a candidate for **rowwise**?

Similarly, this will not give the answer we probably expect:

```
rfm_table %>%  
  mutate(mean_lo = mean(c(lo_r, lo_f, lo_m)),  
         mean_hi = mean(c(hi_r, hi_f, hi_m))) %>%  
  select(segment, mean_lo, mean_hi, everything())
```

```
## # A tibble: 11 × 10
```

##	segment	mean_lo	mean_hi	lo_r	hi_r	lo_f	hi_f	lo_m	hi_m	description
##	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<chr>
##	1 Champions	1.67	3.18	4	5	4	5	4	5	Bought rec...
##	2 Loyal Customers	1.67	3.18	2	5	3	5	3	5	Spend good...
##	3 Potential Loyalist	1.67	3.18	3	5	1	3	1	3	Recent cus...
##	4 New Customers	1.67	3.18	4	5	0	1	0	1	Bought mor...
##	5 Promising	1.67	3.18	3	4	0	1	0	1	Recent sho...
##	6 Need Attention	1.67	3.18	2	3	2	3	2	3	Above aver...
##	7 About To Sleep	1.67	3.18	2	3	0	2	0	2	Below aver...
##	8 At Risk	1.67	3.18	0	2	2	5	2	5	Spent big ...
##	9 Can't Lose Them	1.67	3.18	0	1	4	5	4	5	Made big p...
##	10 Hibernating	1.67	3.18	1	2	1	2	1	2	Low spende...
##	11 Lost	1.67	3.18	0	2	0	2	0	2	Lowest rec...

Maybe a candidate for **rowwise**?

But this will:

```
rfm_table %>%  
  rowwise() %>%  
  mutate(mean_lo = mean(c(lo_r, lo_f, lo_m)),  
         mean_hi = mean(c(hi_r, hi_f, hi_m))) %>%  
  select(segment, mean_lo, mean_hi, everything())
```

```
## # A tibble: 11 × 10
```

```
## # Rowwise:
```

##	segment	mean_lo	mean_hi	lo_r	hi_r	lo_f	hi_f	lo_m	hi_m	description
##	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<chr>
##	1 Champions	4	5	4	5	4	5	4	5	Bought rec...
##	2 Loyal Customers	2.67	5	2	5	3	5	3	5	Spend good...
##	3 Potential Loyalist	1.67	3.67	3	5	1	3	1	3	Recent cus...
##	4 New Customers	1.33	2.33	4	5	0	1	0	1	Bought mor...
##	5 Promising	1	2	3	4	0	1	0	1	Recent sho...
##	6 Need Attention	2	3	2	3	2	3	2	3	Above aver...
##	7 About To Sleep	0.667	2.33	2	3	0	2	0	2	Below aver...
##	8 At Risk	1.33	4	0	2	2	5	2	5	Spent big ...
##	9 Can't Lose Them	2.67	3.67	0	1	4	5	4	5	Made big p...
##	10 Hibernating	1	2	1	2	1	2	1	2	Low spende...
##	11 Lost	0	2	0	2	0	2	0	2	Lowest rec...

Rowwise operations aren't very efficient

In general, you'll want to see if some vectorized ("operating on columns, but elementwise") function exists, as it'll be faster.

And most of the time, R and the tidyverse "wants" you to work in vectorized, columnar terms ... hence your first move will often be to pivot the data into long format.

So, `rowwise()` is not likely to see a whole lot of further development.

You probably want `group_by()` instead

```
rfm_table %>%  
  group_by(segment) %>%  
  mutate(mean_lo = mean(c(lo_r, lo_f, lo_m)),  
         mean_hi = mean(c(hi_r, hi_f, hi_m))) %>%  
  select(segment, mean_lo, mean_hi, everything())
```

```
## # A tibble: 11 × 10
```

```
## # Groups:   segment [11]
```

##	segment	mean_lo	mean_hi	lo_r	hi_r	lo_f	hi_f	lo_m	hi_m	description
##	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<chr>
##	1 Champions	4	5	4	5	4	5	4	5	Bought rec...
##	2 Loyal Customers	2.67	5	2	5	3	5	3	5	Spend good...
##	3 Potential Loyalist	1.67	3.67	3	5	1	3	1	3	Recent cus...
##	4 New Customers	1.33	2.33	4	5	0	1	0	1	Bought mor...
##	5 Promising	1	2	3	4	0	1	0	1	Recent sho...
##	6 Need Attention	2	3	2	3	2	3	2	3	Above aver...
##	7 About To Sleep	0.667	2.33	2	3	0	2	0	2	Below aver...
##	8 At Risk	1.33	4	0	2	2	5	2	5	Spent big ...
##	9 Can't Lose Them	2.67	3.67	0	1	4	5	4	5	Made big p...
##	10 Hibernating	1	2	1	2	1	2	1	2	Low spende...
##	11 Lost	0	2	0	2	0	2	0	2	Lowest rec...

You probably want `group_by()` instead

```
rfm_table %>%  
  group_by(segment) %>%  
  mutate(sum_lo = sum(lo_r, lo_f, lo_m),  
         sum_hi = sum(hi_r, hi_f, hi_m)) %>%  
  select(segment, sum_lo, sum_hi, everything())
```

```
## # A tibble: 11 × 10
```

```
## # Groups:   segment [11]
```

##	segment	sum_lo	sum_hi	lo_r	hi_r	lo_f	hi_f	lo_m	hi_m	description
##	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<chr>
##	1 Champions	12	15	4	5	4	5	4	5	Bought rec...
##	2 Loyal Customers	8	15	2	5	3	5	3	5	Spend good...
##	3 Potential Loyalist	5	11	3	5	1	3	1	3	Recent cus...
##	4 New Customers	4	7	4	5	0	1	0	1	Bought mor...
##	5 Promising	3	6	3	4	0	1	0	1	Recent sho...
##	6 Need Attention	6	9	2	3	2	3	2	3	Above aver...
##	7 About To Sleep	2	7	2	3	0	2	0	2	Below aver...
##	8 At Risk	4	12	0	2	2	5	2	5	Spent big ...
##	9 Can't Lose Them	8	11	0	1	4	5	4	5	Made big p...
##	10 Hibernating	3	6	1	2	1	2	1	2	Low spende...
##	11 Lost	0	6	0	2	0	2	0	2	Lowest rec...

What about Stata?

Using **haven**

Haven is the Tidyverse's package for reading and managing files from Stata, SPSS, and SAS. You should prefer it to the older Base R package `foreign`, which has similar functionality.

We're going to import a General Social Survey dataset that's in Stata's `.dta` format.

```
library(haven)

# This will take a moment
gss_panel <- read_stata(here("data", "gss_panel_long.dta"))
```

We'll do some of the common recoding and reorganizing tasks that accompany this.

The GSS panel

The data:

```
gss_panel
```

```
## # A tibble: 14,610 × 2,757
```

```
##   firstyear firstid year   id vpsu vstrat adults ballot dateintv famgen
##   <dbl> <dbl+lbl> <dbl> <dbl> <dbl+> <dbl+> <dbl+> <dbl+1> <dbl+lb> <dbl+1>
## 1     2006         9 2006    9      2  1957      1 3 [BAL...    709 1 [1 G...
## 2     2006         9 2008 3001    NA    NA      2 3 [BAL...    503 1 [1 G...
## 3     2006         9 2010 6001 NA(i)    NA      2 3 [BAL...    508 1 [1 G...
## 4     2006        10 2010 6002 NA(i)    NA      1 1 [BAL...    408 1 [1 G...
## 5     2006        10 2006    10      2  1957      2 1 [BAL...    630 2 [2 G...
## 6     2006        10 2008 3002    NA    NA      2 1 [BAL...    426 2 [2 G...
## 7     2006        11 2008 3003    NA    NA      2 3 [BAL...    718 4 [2 G...
## 8     2006        11 2010 6003 NA(i)    NA NA(n) 3 [BAL...    518 2 [2 G...
## 9     2006        11 2006    11      2  1957      2 3 [BAL...    630 4 [2 G...
## 10    2006        12 2010 6004 NA(i)    NA      4 1 [BAL...    324 2 [2 G...
```

```
## # ... with 14,600 more rows, and 2,747 more variables: form <dbl+lbl>,
## # formwt <dbl>, gender1 <dbl+lbl>, hompop <dbl+lbl>, intage <dbl+lbl>,
## # intid <dbl+lbl>, intyrs <dbl+lbl>, mode <dbl+lbl>, oversamp <dbl>,
## # phase <dbl+lbl>, race <dbl+lbl>, reg16 <dbl+lbl>, region <dbl+lbl>,
## # relate1 <dbl+lbl>, relhh1 <dbl+lbl>, relhhd1 <dbl+lbl>, respnum <dbl+lbl>,
## # rvisitor <dbl+lbl>, sampcode <dbl+lbl>, sample <dbl+lbl>, sex <dbl+lbl>,
## # size <dbl+lbl>, spaneng <dbl+lbl>, srcbelt <dbl+lbl>, version <dbl>, ...
```

The GSS panel

Many variables.

Stata's missing value types are preserved

Data types are things like `db1+1b1` indicating that Stata's numeric values and variable labels have been preserved.

The GSS panel

You can see the labeling system at work:

```
gss_panel %>%  
  select(degree) %>%  
  group_by(degree) %>%  
  tally()
```

```
## # A tibble: 6 × 2  
##           degree      n  
##           <dbl> <int>  
## 1  0 [LT HIGH SCHOOL] 1850  
## 2  1 [HIGH SCHOOL]    7274  
## 3  2 [JUNIOR COLLEGE] 1161  
## 4  3 [bachelor]       2767  
## 5  4 [graduate]       1556  
## 6 NA(d)              2
```

The GSS panel

Values get pivoted, not labels, though.

```
gss_panel %>%  
  select(sex, degree) %>%  
  group_by(sex, degree) %>%  
  tally() %>%  
  pivot_wider(names_from = sex, values_from = n)
```

```
## # A tibble: 6 × 3  
##           degree   `1`   `2`  
##           <dbl> <int> <int>  
## 1  0 [LT HIGH SCHOOL]    814  1036  
## 2  1 [HIGH SCHOOL]      3131  4143  
## 3  2 [JUNIOR COLLEGE]    440   721  
## 4  3 [bachelor]         1293  1474  
## 5  4 [graduate]         696   860  
## 6 NA(d)                NA     2
```

The GSS panel

Option 1: Just drop all the labels.

```
gss_panel %>%  
  zap_missing() %>%  
  zap_labels()
```

```
## # A tibble: 14,610 × 2,757  
##   firstyear firstid  year    id  vpsu vstrat adults ballot dateintv famgen  
##   <dbl>    <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1      2006      9  2006      9      2  1957      1      3      709      1  
## 2      2006      9  2008    3001    NA     NA      2      3      503      1  
## 3      2006      9  2010    6001    NA     NA      2      3      508      1  
## 4      2006     10  2010    6002    NA     NA      1      1      408      1  
## 5      2006     10  2006     10      2  1957      2      1      630      2  
## 6      2006     10  2008    3002    NA     NA      2      1      426      2  
## 7      2006     11  2008    3003    NA     NA      2      3      718      4  
## 8      2006     11  2010    6003    NA     NA     NA      3      518      2  
## 9      2006     11  2006     11      2  1957      2      3      630      4  
## 10     2006     12  2010    6004    NA     NA      4      1      324      2  
## # ... with 14,600 more rows, and 2,747 more variables: form <dbl>, formwt <dbl>,  
## #   gender1 <dbl>, hompop <dbl>, intage <dbl>, intid <dbl>, intyrs <dbl>,  
## #   mode <dbl>, oversamp <dbl>, phase <dbl>, race <dbl>, reg16 <dbl>,  
## #   region <dbl>, relate1 <dbl>, relhh1 <dbl>, relhhd1 <dbl>, respnum <dbl>,  
## #   rvisitor <dbl>, sampcode <dbl>, sample <dbl>, sex <dbl>, size <dbl>,  
## #   spaneng <dbl>, srcbelt <dbl>, version <dbl>, visitors <dbl>, wtss <dbl>,  
## #   wtssall <dbl>, wtssnr <dbl>, xnorcsiz <dbl>, hispanic <dbl>, ...
```

The GSS panel

Option 2: Convert the labels

Let's focus on a few measures of interest, and do some recoding.

```
### Categorical vars
cat_vars <- c("race", "sex", "degree", "relig", "income", "polviews", "fefam")

### Integer vars
int_vars <- c("year", "id", "ballot", "age", "tvhours")

### Survey design
wt_vars <- c("vpsu",
            "vstrat",
            "oversamp",
            "formwt",      # weight to deal with experimental randomization
            "wtssall",     # weight variable
            "sampcode",    # sampling error code
            "sample")      # sampling frame and method

my_gss_vars <- c(int_vars, cat_vars, wt_vars)
```

Now we're ready to go ...

Cut down the dataset

```
gss_sub <- gss_panel %>%  
  select(all_of(my_gss_vars))
```

```
gss_sub
```

```
## # A tibble: 14,610 × 19
```

```
##   year   id   ballot   age   tvhours   race   sex   degree   relig  
##   <dbl> <dbl> <dbl+lbl> <dbl+lbl> <dbl+lbl> <dbl+l> <dbl+l> <dbl+l> <dbl+l>  
## 1  2006     9 3 [BALLOT C]    23 NA(a) [iap] 2 [bla... 2 [fem... 3 [bac... 4 [non...  
## 2  2008   3001 3 [BALLOT C]    25 NA(i)      3 [oth... 2 [fem... 3 [bac... 4 [non...  
## 3  2010   6001 3 [BALLOT C]    27 NA(i)      2 [bla... 2 [fem... 3 [bac... 4 [non...  
## 4  2010   6002 1 [BALLOT A]    36      3      1 [whi... 2 [fem... 4 [gra... 4 [non...  
## 5  2006    10 1 [BALLOT A]    32      3      3 [oth... 2 [fem... 4 [gra... 4 [non...  
## 6  2008   3002 1 [BALLOT A]    34      3      3 [oth... 2 [fem... 4 [gra... 4 [non...  
## 7  2008   3003 3 [BALLOT C]    83 NA(i)      2 [bla... 2 [fem... 0 [LT ... 1 [pro...  
## 8  2010   6003 3 [BALLOT C]    85 NA(i)      2 [bla... 2 [fem... 0 [LT ... 1 [pro...  
## 9  2006    11 3 [BALLOT C]    81 NA(a) [iap] 2 [bla... 2 [fem... 0 [LT ... 1 [pro...  
## 10 2010   6004 1 [BALLOT A]    51    10      3 [oth... 1 [mal... 1 [HIG... 2 [cat...  
## # ... with 14,600 more rows, and 10 more variables: income <dbl+lbl>,  
## #   polviews <dbl+lbl>, fefam <dbl+lbl>, vpsu <dbl+lbl>, vstrat <dbl+lbl>,  
## #   oversamp <dbl>, formwt <dbl>, wtssall <dbl+lbl>, sampcode <dbl+lbl>,  
## #   sample <dbl+lbl>
```

The GSS panel: recoding

```
gss_sub .panel2-gss1-auto[
```

```
## # A tibble: 14,610 × 19
##   year   id   ballot   age   tvhours   race   sex   degree   relig
##   <dbl> <dbl>   <dbl+lbl> <dbl+lbl> <dbl+lbl> <dbl+lbl> <dbl+lbl> <dbl+lbl> <dbl+lbl>
## 1  2006     9 3 [BALLOT C]    23 NA(a) [iap] 2 [bla... 2 [fem... 3 [bac... 4 [non...
## 2  2008   3001 3 [BALLOT C]    25 NA(i)      3 [oth... 2 [fem... 3 [bac... 4 [non...
## 3  2010   6001 3 [BALLOT C]    27 NA(i)      2 [bla... 2 [fem... 3 [bac... 4 [non...
## 4  2010   6002 1 [BALLOT A]    36      3      1 [whi... 2 [fem... 4 [gra... 4 [non...
## 5  2006    10 1 [BALLOT A]    32      3      3 [oth... 2 [fem... 4 [gra... 4 [non...
## 6  2008   3002 1 [BALLOT A]    34      3      3 [oth... 2 [fem... 4 [gra... 4 [non...
## 7  2008   3003 3 [BALLOT C]    83 NA(i)      2 [bla... 2 [fem... 0 [LT ... 1 [pro...
## 8  2010   6003 3 [BALLOT C]    85 NA(i)      2 [bla... 2 [fem... 0 [LT ... 1 [pro...
## 9  2006    11 3 [BALLOT C]    81 NA(a) [iap] 2 [bla... 2 [fem... 0 [LT ... 1 [pro...
## 10 2010   6004 1 [BALLOT A]    51    10      3 [oth... 1 [mal... 1 [HIG... 2 [cat...
## # ... with 14,600 more rows, and 10 more variables: income <dbl+lbl>,
## #   polviews <dbl+lbl>, fefam <dbl+lbl>, vpsu <dbl+lbl>, vstrat <dbl+lbl>,
## #   oversamp <dbl>, formwt <dbl>, wtssall <dbl+lbl>, sampcode <dbl+lbl>,
## #   sample <dbl+lbl>
```

```
]
```

The GSS panel: recoding

```
gss_sub %>%
```

```
  mutate(across(everything(), zap_missing()))
```

```
.panel2-gss1-auto[
```

```
## # A tibble: 14,610 × 19
```

```
##   year   id ballot  age tvhours  race  sex degree  relig  income
##   <dbl> <dbl> <dbl+lbl> <dbl+> <dbl+lbl> <dbl+lbl> <dbl+lbl> <dbl+lbl> <dbl+lbl> <dbl+lbl>
## 1  2006     9 3 [BALL... 23      NA 2 [bla... 2 [fem... 3 [bac... 4 [non... 12 [$25...
## 2  2008   3001 3 [BALL... 25      NA 3 [oth... 2 [fem... 3 [bac... 4 [non... 12 [$25...
## 3  2010   6001 3 [BALL... 27      NA 2 [bla... 2 [fem... 3 [bac... 4 [non... 12 [$25...
## 4  2010   6002 1 [BALL... 36       3 1 [whi... 2 [fem... 4 [gra... 4 [non... 12 [$25...
## 5  2006    10 1 [BALL... 32       3 3 [oth... 2 [fem... 4 [gra... 4 [non... NA
## 6  2008   3002 1 [BALL... 34       3 3 [oth... 2 [fem... 4 [gra... 4 [non... 12 [$25...
## 7  2008   3003 3 [BALL... 83      NA 2 [bla... 2 [fem... 0 [LT ... 1 [pro... 11 [$20...
## 8  2010   6003 3 [BALL... 85      NA 2 [bla... 2 [fem... 0 [LT ... 1 [pro... NA
## 9  2006    11 3 [BALL... 81      NA 2 [bla... 2 [fem... 0 [LT ... 1 [pro... NA
## 10 2010   6004 1 [BALL... 51     10 3 [oth... 1 [mal... 1 [HIG... 2 [cat... 1 [LT ...
## # ... with 14,600 more rows, and 9 more variables: polviews <dbl+lbl>,
## #   fefam <dbl+lbl>, vpsu <dbl+lbl>, vstrat <dbl+lbl>, oversamp <dbl>,
## #   formwt <dbl>, wtssall <dbl+lbl>, sampcode <dbl+lbl>, sample <dbl+lbl>
```

```
]
```

The GSS panel: recoding

```
gss_sub %>%  
  mutate(across(everything(), zap_missing)) %>%  
  mutate(across(all_of(wt_vars), as.numeric))
```

.panel2-gss1-auto[

A tibble: 14,610 × 19

```
##      year   id ballot   age tvhours  race    sex degree  relig  income  
##      <dbl> <dbl> <dbl+lbl> <dbl+> <dbl+lbl> <dbl+lbl> <dbl+lbl> <dbl+lbl> <dbl+lbl> <dbl+lbl>  
## 1  2006     9 3 [BALL...  23      NA 2 [bla... 2 [fem... 3 [bac... 4 [non... 12 [$25...  
## 2  2008   3001 3 [BALL...  25      NA 3 [oth... 2 [fem... 3 [bac... 4 [non... 12 [$25...  
## 3  2010   6001 3 [BALL...  27      NA 2 [bla... 2 [fem... 3 [bac... 4 [non... 12 [$25...  
## 4  2010   6002 1 [BALL...  36       3 1 [whi... 2 [fem... 4 [gra... 4 [non... 12 [$25...  
## 5  2006    10 1 [BALL...  32       3 3 [oth... 2 [fem... 4 [gra... 4 [non... NA  
## 6  2008   3002 1 [BALL...  34       3 3 [oth... 2 [fem... 4 [gra... 4 [non... 12 [$25...  
## 7  2008   3003 3 [BALL...  83      NA 2 [bla... 2 [fem... 0 [LT ... 1 [pro... 11 [$20...  
## 8  2010   6003 3 [BALL...  85      NA 2 [bla... 2 [fem... 0 [LT ... 1 [pro... NA  
## 9  2006    11 3 [BALL...  81      NA 2 [bla... 2 [fem... 0 [LT ... 1 [pro... NA  
## 10 2010   6004 1 [BALL...  51     10 3 [oth... 1 [mal... 1 [HIG... 2 [cat... 1 [LT ...  
## # ... with 14,600 more rows, and 9 more variables: polviews <dbl+lbl>,  
## #   fefam <dbl+lbl>, vpsu <dbl>, vstrat <dbl>, oversamp <dbl>, formwt <dbl>,  
## #   wtssall <dbl>, sampcode <dbl>, sample <dbl>
```

]

The GSS panel: recoding

```
gss_sub %>%  
  mutate(across(everything(), zap_missing)) %>%  
  mutate(across(all_of(wt_vars), as.numeric)) %>%  
  mutate(across(all_of(int_vars), as.integer))
```

.panel2-gss1-auto[

```
## # A tibble: 14,610 × 19  
##   year   id ballot age tvhours race sex degree relig in  
##   <int> <int> <int> <int> <int> <dbl+lbl> <dbl+lbl> <dbl+l> <dbl+l> <dbl+lb>  
## 1  2006     9     3    23    NA 2 [black] 2 [female] 3 [bac... 4 [non... 12 [$25...  
## 2  2008   3001     3    25    NA 3 [other] 2 [female] 3 [bac... 4 [non... 12 [$25...  
## 3  2010   6001     3    27    NA 2 [black] 2 [female] 3 [bac... 4 [non... 12 [$25...  
## 4  2010   6002     1    36     3 1 [white] 2 [female] 4 [gra... 4 [non... 12 [$25...  
## 5  2006    10     1    32     3 3 [other] 2 [female] 4 [gra... 4 [non... NA  
## 6  2008   3002     1    34     3 3 [other] 2 [female] 4 [gra... 4 [non... 12 [$25...  
## 7  2008   3003     3    83    NA 2 [black] 2 [female] 0 [LT ... 1 [pro... 11 [$20...  
## 8  2010   6003     3    85    NA 2 [black] 2 [female] 0 [LT ... 1 [pro... NA  
## 9  2006    11     3    81    NA 2 [black] 2 [female] 0 [LT ... 1 [pro... NA  
## 10 2010   6004     1    51    10 3 [other] 1 [male]  1 [HIG... 2 [cat...  1 [LT ...  
## # ... with 14,600 more rows, and 9 more variables: polviews <dbl+lbl>,  
## #   fefam <dbl+lbl>, vpsu <dbl>, vstrat <dbl>, oversamp <dbl>, formwt <dbl>,  
## #   wtssall <dbl>, sampcode <dbl>, sample <dbl>
```

]

The GSS panel: recoding

```
gss_sub %>%  
  mutate(across(everything(), zap_missing)) %>%  
  mutate(across(all_of(wt_vars), as.numeric)) %>%  
  mutate(across(all_of(int_vars), as.integer)) %>%  
  mutate(across(all_of(cat_vars), as_factor))
```

```
## # A tibble: 14,610 × 19  
##   year   id ballot age tvhours race sex degree relig income polviews  
##   <int> <int> <int> <int> <int> <fct> <fct> <fct> <fct> <fct> <fct>  
## 1  2006     9      3  23      NA black female bachel... none $25000... conserv...  
## 2  2008   3001      3  25      NA other female bachel... none $25000... EXTREME...  
## 3  2010   6001      3  27      NA black female bachel... none $25000... EXTREME...  
## 4  2010   6002      1  36       3 white female gradua... none $25000... liberal  
## 5  2006     10      1  32       3 other female gradua... none <NA> SLIGHTL...  
## 6  2008   3002      1  34       3 other female gradua... none $25000... moderate  
## 7  2008   3003      3  83      NA black female LT HIG... prote... $20000... liberal  
## 8  2010   6003      3  85      NA black female LT HIG... prote... <NA> moderate  
## 9  2006     11      3  81      NA black female LT HIG... prote... <NA> moderate  
## 10 2010   6004      1  51      10 other male HIGH S... catho... LT $10... liberal  
## # ... with 14,600 more rows, and 8 more variables: fefam <fct>, vpsu <dbl>,  
## # vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,  
## # sample <dbl>
```

The GSS panel: recoding

```
gss_sub %>%  
  mutate(across(everything(), zap_missing)) %>%  
  mutate(across(all_of(wt_vars), as.numeric)) %>%  
  mutate(across(all_of(int_vars), as.integer)) %>%  
  mutate(across(all_of(cat_vars), as_factor)) %>%  
  mutate(across(all_of(cat_vars), fct_relabel, to]
```

```
## # A tibble: 14,610 × 19  
##   year   id ballot age tvhours race sex degree relig income polviews  
##   <int> <int> <int> <int> <int> <fct> <fct> <fct> <fct> <fct> <fct>  
## 1  2006     9      3  23      NA black female bachel... none  $25000... conserv...  
## 2  2008    3001     3  25      NA other female bachel... none  $25000... extreme...  
## 3  2010    6001     3  27      NA black female bachel... none  $25000... extreme...  
## 4  2010    6002     1  36       3 white female gradua... none  $25000... liberal  
## 5  2006     10     1  32       3 other female gradua... none  <NA>    slightl...  
## 6  2008    3002     1  34       3 other female gradua... none  $25000... moderate  
## 7  2008    3003     3  83      NA black female lt hig... prote... $20000... liberal  
## 8  2010    6003     3  85      NA black female lt hig... prote... <NA>    moderate  
## 9  2006     11     3  81      NA black female lt hig... prote... <NA>    moderate  
## 10 2010    6004     1  51      10 other male  high s... catho... lt $10... liberal  
## # ... with 14,600 more rows, and 8 more variables: fefam <fct>, vpsu <dbl>,  
## # vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,  
## # sample <dbl>
```

The GSS panel: recoding

```
gss_sub %>%
  mutate(across(everything(), zap_missing)) %>%
  mutate(across(all_of(wt_vars), as.numeric)) %>%
  mutate(across(all_of(int_vars), as.integer)) %>%
  mutate(across(all_of(cat_vars), as_factor)) %>%
  mutate(across(all_of(cat_vars), fct_relabel, to))
  mutate(across(all_of(cat_vars), fct_relabel, to))
```

```
## # A tibble: 14,610 × 19
##   year   id ballot age tvhours race sex degree relig income polviews
##   <int> <int> <int> <int> <int> <fct> <fct> <fct> <fct> <fct> <fct>
## 1  2006     9      3   23      NA Black Female Bachel... None $25000... Conserv...
## 2  2008   3001     3   25      NA Other Female Bachel... None $25000... Extreme...
## 3  2010   6001     3   27      NA Black Female Bachel... None $25000... Extreme...
## 4  2010   6002     1   36        3 White Female Gradua... None $25000... Liberal
## 5  2006    10     1   32        3 Other Female Gradua... None <NA> Slightl...
## 6  2008   3002     1   34        3 Other Female Gradua... None $25000... Moderate
## 7  2008   3003     3   83      NA Black Female Lt Hig... Prote... $20000... Liberal
## 8  2010   6003     3   85      NA Black Female Lt Hig... Prote... <NA> Moderate
## 9  2006    11     3   81      NA Black Female Lt Hig... Prote... <NA> Moderate
## 10 2010   6004     1   51      10 Other Male High S... Catho... Lt $10... Liberal
## # ... with 14,600 more rows, and 8 more variables: fefam <fct>, vpsu <dbl>,
## # vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## # sample <dbl>
```


The GSS panel: recoding

```
gss_sub %>%  
  mutate(across(everything(), zap_missing)) %>%  
  mutate(across(all_of(wt_vars), as.numeric)) %>%  
  mutate(across(all_of(int_vars), as.integer)) %>%  
  mutate(across(all_of(cat_vars), as_factor)) %>%  
  mutate(across(all_of(cat_vars), fct_relabel, to = ...))  
  mutate(across(all_of(cat_vars), fct_relabel, to = ...))  
  mutate(income = stringr::str_replace(income, "
```

```
## # A tibble: 14,610 × 19  
##   year   id ballot age tvhours race sex degree relig income polviews  
##   <int> <int> <int> <int> <int> <fct> <fct> <fct> <fct> <chr> <fct>  
## 1  2006     9      3  23      NA Black Female Bachel... None  $25000... Conserv...  
## 2  2008    3001     3  25      NA Other Female Bachel... None  $25000... Extreme...  
## 3  2010    6001     3  27      NA Black Female Bachel... None  $25000... Extreme...  
## 4  2010    6002     1  36        3 White Female Gradua... None  $25000... Liberal  
## 5  2006     10     1  32        3 Other Female Gradua... None  <NA>    Slightl...  
## 6  2008    3002     1  34        3 Other Female Gradua... None  $25000... Moderate  
## 7  2008    3003     3  83      NA Black Female Lt Hig... Prote... $20000... Liberal  
## 8  2010    6003     3  85      NA Black Female Lt Hig... Prote... <NA>    Moderate  
## 9  2006     11     3  81      NA Black Female Lt Hig... Prote... <NA>    Moderate  
## 10 2010    6004     1  51       10 Other Male   High S... Catho... Lt $10... Liberal  
## # ... with 14,600 more rows, and 8 more variables: fefam <fct>, vpsu <dbl>,  
## # vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,  
## # sample <dbl>
```

How we'd actually write this

```
gss_sub <- gss_sub %>%  
  mutate(across(everything(), zap_missing),  
    across(all_of(wt_vars), as.numeric),  
    across(all_of(int_vars), as.integer),  
    across(all_of(cat_vars), as_factor),  
    across(all_of(cat_vars), fct_relabel, tolower),  
    across(all_of(cat_vars), fct_relabel, tools::toTitleCase),  
    income = stringr::str_replace(income, " - ", "-"))
```

The GSS panel: more recoding

Age quintiles: find the cutpoints

```
# seq can make all kinds of sequences  
seq(from = 0, to = 1, by = 0.2)
```

```
## [1] 0.0 0.2 0.4 0.6 0.8 1.0
```

```
age_quintiles <- quantile(as.numeric(gss_panel$age),  
                          probs = seq(0, 1, 0.2),  
                          na.rm = TRUE)
```

```
## These are the quintile cutpoints  
age_quintiles
```

```
##    0%   20%   40%   60%   80%  100%  
##    18    33    43    53    65    89
```

The GSS panel: more recoding

Age quintiles: create the quintile variable

```
## Apply the cut
gss_sub %>%
  mutate(agequint = cut(x = age,
                        breaks = unique(age_quintiles),
                        include.lowest = TRUE)) %>%
  pull(agequint) %>% # grab a column and make it an ordinary vector
  table()
```

```
## .
## [18,33] (33,43] (43,53] (53,65] (65,89]
##      3157      2680      2851      3057      2720
```

We'll need clean up those labels.

The GSS panel: more recoding

I told you that regexp stuff would pay off.

```
convert_agegrp <- function(x){  
  x <- stringr::str_remove(x, "\\(") # Remove open paren  
  x <- stringr::str_remove(x, "\\[") # Remove open bracket  
  x <- stringr::str_remove(x, "\\]") # Remove close bracket  
  x <- stringr::str_replace(x, ",", "-") # Replace comma with dash  
  x <- stringr::str_replace(x, "-89", "+") # Replace -89 with +  
  regex <- "^(.*$)" # Matches everything in string to end of line  
  x <- stringr::str_replace(x, regex, "Age \\1") # Preface string with "Age"  
  x  
}
```

The GSS panel: more recoding

```
gss_sub
```

```
## # A tibble: 14,610 × 19
```

```
##   year   id ballot  age tvhours race  sex  degree  relig  income  polviews
##   <int> <int> <int> <int>   <int> <fct> <fct> <fct> <fct> <chr> <fct>
## 1  2006     9     3    23      NA Black Female Bachel... None  $25000... Conserv...
## 2  2008   3001     3    25      NA Other Female Bachel... None  $25000... Extreme...
## 3  2010   6001     3    27      NA Black Female Bachel... None  $25000... Extreme...
## 4  2010   6002     1    36       3 White Female Gradua... None  $25000... Liberal
## 5  2006    10     1    32       3 Other Female Gradua... None   <NA>  Slightl...
## 6  2008   3002     1    34       3 Other Female Gradua... None  $25000... Moderate
## 7  2008   3003     3    83      NA Black Female Lt Hig... Prote... $20000... Liberal
## 8  2010   6003     3    85      NA Black Female Lt Hig... Prote... <NA>    Moderate
## 9  2006    11     3    81      NA Black Female Lt Hig... Prote... <NA>    Moderate
## 10 2010   6004     1    51      10 Other Male  High S... Catho... Lt $10... Liberal
## # ... with 14,600 more rows, and 8 more variables: fefam <fct>, vpsu <dbl>,
## # vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## # sample <dbl>
```

The GSS panel: more recoding

```
gss_sub %>%
```

```
  mutate(agequint = cut(x = age,  
                        breaks = unique(age_quintiles),  
                        include.lowest = TRUE))
```

```
## # A tibble: 14,610 × 20
```

```
##   year   id ballot  age tvhours race  sex  degree  relig  income  polviews  
##   <int> <int> <int> <int>   <int> <fct> <fct> <fct> <fct> <chr> <fct>  
## 1  2006     9     3   23      NA Black Female Bachel... None  $25000... Conserv..  
## 2  2008   3001     3   25      NA Other Female Bachel... None  $25000... Extreme..  
## 3  2010   6001     3   27      NA Black Female Bachel... None  $25000... Extreme..  
## 4  2010   6002     1   36       3 White Female Gradua... None  $25000... Liberal  
## 5  2006    10     1   32       3 Other Female Gradua... None  <NA>    Slightl..  
## 6  2008   3002     1   34       3 Other Female Gradua... None  $25000... Moderate  
## 7  2008   3003     3   83      NA Black Female Lt Hig... Prote... $20000... Liberal  
## 8  2010   6003     3   85      NA Black Female Lt Hig... Prote... <NA>    Moderate  
## 9  2006    11     3   81      NA Black Female Lt Hig... Prote... <NA>    Moderate  
## 10 2010   6004     1   51      10 Other Male  High S... Catho... Lt $10... Liberal  
## # ... with 14,600 more rows, and 9 more variables: fefam <fct>, vpsu <dbl>,  
## # vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,  
## # sample <dbl>, agequint <fct>
```

The GSS panel: more recoding

```
gss_sub %>%  
  mutate(agequint = cut(x = age,  
                        breaks = unique(age_quintiles),  
                        include.lowest = TRUE)) %>%  
  mutate(agequint = fct_relabel(agequint, convert_agegrp))
```

```
## # A tibble: 14,610 × 20
```

```
##   year   id ballot  age tvhours race  sex  degree  relig  income  polviews  
##   <int> <int> <int> <int>   <int> <fct> <fct> <fct> <fct> <chr> <fct>  
## 1  2006     9      3   23      NA Black Female Bachel... None  $25000... Conserv..  
## 2  2008   3001      3   25      NA Other Female Bachel... None  $25000... Extreme..  
## 3  2010   6001      3   27      NA Black Female Bachel... None  $25000... Extreme..  
## 4  2010   6002      1   36        3 White Female Gradua... None  $25000... Liberal  
## 5  2006    10      1   32        3 Other Female Gradua... None  <NA>    Slightl..  
## 6  2008   3002      1   34        3 Other Female Gradua... None  $25000... Moderate  
## 7  2008   3003      3   83      NA Black Female Lt Hig... Prote... $20000... Liberal  
## 8  2010   6003      3   85      NA Black Female Lt Hig... Prote... <NA>    Moderate  
## 9  2006    11      3   81      NA Black Female Lt Hig... Prote... <NA>    Moderate  
## 10 2010   6004      1   51      10 Other Male  High S... Catho... Lt $10... Liberal  
## # ... with 14,600 more rows, and 9 more variables: fefam <fct>, vpsu <dbl>,  
## # vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,  
## # sample <dbl>, agequint <fct>
```


The GSS panel: more recoding

```
gss_sub %>%  
  mutate(agequint = cut(x = age,  
                        breaks = unique(age_quintiles),  
                        include.lowest = TRUE)) %>%  
  mutate(agequint = fct_relabel(agequint, convert_agegrp)) %>%  
  mutate(year_f = droplevels(factor(year)))
```

```
## # A tibble: 14,610 × 21
```

```
##   year   id ballot  age tvhours race  sex  degree  relig  income  polviews  
##   <int> <int> <int> <int>   <int> <fct> <fct> <fct> <fct> <chr> <fct>  
## 1  2006     9      3   23      NA Black Female Bachel... None  $25000... Conserv..  
## 2  2008   3001      3   25      NA Other Female Bachel... None  $25000... Extreme..  
## 3  2010   6001      3   27      NA Black Female Bachel... None  $25000... Extreme..  
## 4  2010   6002      1   36       3 White Female Gradua... None  $25000... Liberal  
## 5  2006    10      1   32       3 Other Female Gradua... None  <NA>    Slightl..  
## 6  2008   3002      1   34       3 Other Female Gradua... None  $25000... Moderate  
## 7  2008   3003      3   83      NA Black Female Lt Hig... Prote... $20000... Liberal  
## 8  2010   6003      3   85      NA Black Female Lt Hig... Prote... <NA>    Moderate  
## 9  2006    11      3   81      NA Black Female Lt Hig... Prote... <NA>    Moderate  
## 10 2010   6004      1   51      10 Other Male  High S... Catho... Lt $10... Liberal  
## # ... with 14,600 more rows, and 10 more variables: fefam <fct>, vpsu <dbl>,  
## # vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,  
## # sample <dbl>, agequint <fct>, year_f <fct>
```

The GSS panel: more recoding

```
gss_sub %>%
  mutate(agequint = cut(x = age,
                        breaks = unique(age_quintiles),
                        include.lowest = TRUE)) %>%
  mutate(agequint = fct_relabel(agequint, convert_agegrp)) %>%
  mutate(year_f = droplevels(factor(year))) %>%
  mutate(young = ifelse(age < 26, "Yes", "No"))
```

```
## # A tibble: 14,610 × 22
```

```
##   year   id ballot  age tvhours race  sex  degree  relig  income  polviews
##   <int> <int>   <int> <int>   <int> <fct> <fct>   <fct>   <fct>   <chr>   <fct>
## 1  2006     9     3    23      NA Black Female Bachel... None  $25000... Conserv...
## 2  2008   3001     3    25      NA Other Female Bachel... None  $25000... Extreme...
## 3  2010   6001     3    27      NA Black Female Bachel... None  $25000... Extreme...
## 4  2010   6002     1    36       3 White Female Gradua... None  $25000... Liberal
## 5  2006    10     1    32       3 Other Female Gradua... None   <NA>    Slightl...
## 6  2008   3002     1    34       3 Other Female Gradua... None  $25000... Moderate
## 7  2008   3003     3    83      NA Black Female Lt Hig... Prote... $20000... Liberal
## 8  2010   6003     3    85      NA Black Female Lt Hig... Prote... <NA>    Moderate
## 9  2006    11     3    81      NA Black Female Lt Hig... Prote... <NA>    Moderate
## 10 2010   6004     1    51      10 Other Male   High S... Catho... Lt $10... Liberal
## # ... with 14,600 more rows, and 11 more variables: fefam <fct>, vpsu <dbl>,
## # vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## # sample <dbl>, agequint <fct>, year_f <fct>, young <chr>
```

The GSS panel: more recoding

```
gss_sub %>%
  mutate(agequint = cut(x = age,
                        breaks = unique(age_quintiles),
                        include.lowest = TRUE)) %>%
  mutate(agequint = fct_relabel(agequint, convert_agegrp)) %>%
  mutate(year_f = droplevels(factor(year))) %>%
  mutate(young = ifelse(age < 26, "Yes", "No")) %>%
  mutate(fefam_d = fct_recode(fefam,
                              Agree = "Strongly Agree",
                              Disagree = "Strongly Disagree"))
```

A tibble: 14,610 × 23

##	year	id	ballot	age	tvhours	race	sex	degree	relig	income	polviews	
##	<int>	<int>	<int>	<int>	<int>	<fct>	<fct>	<fct>	<fct>	<chr>	<fct>	
##	1	2006	9	3	23	NA	Black	Female	Bachel...	None	\$25000...	Conserv...
##	2	2008	3001	3	25	NA	Other	Female	Bachel...	None	\$25000...	Extreme...
##	3	2010	6001	3	27	NA	Black	Female	Bachel...	None	\$25000...	Extreme...
##	4	2010	6002	1	36	3	White	Female	Gradua...	None	\$25000...	Liberal
##	5	2006	10	1	32	3	Other	Female	Gradua...	None	<NA>	Slightl...
##	6	2008	3002	1	34	3	Other	Female	Gradua...	None	\$25000...	Moderate
##	7	2008	3003	3	83	NA	Black	Female	Lt Hig...	Prote...	\$20000...	Liberal
##	8	2010	6003	3	85	NA	Black	Female	Lt Hig...	Prote...	<NA>	Moderate
##	9	2006	11	3	81	NA	Black	Female	Lt Hig...	Prote...	<NA>	Moderate
##	10	2010	6004	1	51	10	Other	Male	High S...	Catho...	Lt \$10...	Liberal

... with 14,600 more rows, and 12 more variables: fefam <fct>, vpsu <dbl>,
vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
sample <dbl>, agequint <fct>, year_f <fct>, young <chr>, fefam_d <fct>

The GSS panel: more recoding

```
gss_sub %>%
  mutate(agequint = cut(x = age,
                        breaks = unique(age_quintiles),
                        include.lowest = TRUE)) %>%
  mutate(agequint = fct_relabel(agequint, convert_agegrp)) %>%
  mutate(year_f = droplevels(factor(year))) %>%
  mutate(young = ifelse(age < 26, "Yes", "No")) %>%
  mutate(fefam_d = fct_recode(fefam,
                             Agree = "Strongly Agree",
                             Disagree = "Strongly Disagree"))
  mutate(degree = factor(degree,
                        levels = levels(gss_sub$degree), #<<
                        ordered = TRUE)) #<<
```

```
## # A tibble: 14,610 × 23
```

```
##   year   id ballot   age tvhours race  sex  degree  relig  income  polviews
##   <int> <int>   <int> <int>   <int> <fct> <fct>   <ord>   <fct>   <chr>   <fct>
## 1  2006     9     3    23      NA Black Female Bachel... None  $25000... Conserv...
## 2  2008   3001     3    25      NA Other Female Bachel... None  $25000... Extreme...
## 3  2010   6001     3    27      NA Black Female Bachel... None  $25000... Extreme...
## 4  2010   6002     1    36       3 White Female Gradua... None  $25000... Liberal
## 5  2006    10     1    32       3 Other Female Gradua... None  <NA>    Slightl...
## 6  2008   3002     1    34       3 Other Female Gradua... None  $25000... Moderate
## 7  2008   3003     3    83      NA Black Female Lt Hig... Prote... $20000... Liberal
## 8  2010   6003     3    85      NA Black Female Lt Hig... Prote... <NA>    Moderate
## 9  2006    11     3    81      NA Black Female Lt Hig... Prote... <NA>    Moderate
## 10 2010   6004     1    51     10 Other Male  High S... Catho... Lt $10... Liberal
## # ... with 14,600 more rows, and 12 more variables: fefam <fct>, vpsu <dbl>,
## # vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## # sample <dbl>, agequint <fct>, year_f <fct>, young <chr>, fefam_d <fct>
```

How we'd actually write this

```
gss_sub <- gss_sub %>%  
  mutate(agequint = cut(x = age,  
                        breaks = unique(age_quintiles),  
                        include.lowest = TRUE),  
         agequint = fct_relabel(agequint, convert_agegrp),  
         year_f = droplevels(factor(year)),  
         young = ifelse(age < 26, "Yes", "No"),  
         fefam_d = fct_recode(fefam,  
                              Agree = "Strongly Agree",  
                              Disagree = "Strongly Disagree"),  
         degree = factor(degree,  
                          levels = levels(gss_sub$degree),  
                          ordered = TRUE))
```

How we'd actually write this

```
gss_sub <- gss_sub %>%  
  mutate(agequint = cut(x = age,  
                        breaks = unique(age_quintiles),  
                        include.lowest = TRUE),  
         agequint = fct_relabel(agequint, convert_agegrp),  
         year_f = factor(year),  
         young = ifelse(age < 26, "Yes", "No"),  
         fefam_d = fct_recode(fefam,  
                              Agree = "Strongly Agree",  
                              Disagree = "Strongly Disagree"),  
         degree = factor(degree,  
                          levels = levels(gss_sub$degree),  
                          ordered = TRUE))
```

How we'd actually write this

```
gss_sub <- gss_sub %>%  
  mutate(agequint = cut(x = age,  
                        breaks = unique(age_quintiles),  
                        include.lowest = TRUE),  
    agequint = fct_relabel(agequint, convert_agegrp),  
    year_f = droplevels(factor(year)),  
    young = ifelse(age < 26, "Yes", "No"),  
    fefam_d = fct_recode(fefam,  
                        Agree = "Strongly Agree",  
                        Disagree = "Strongly Disagree"),  
    degree = factor(degree,  
                    levels = levels(gss_sub$degree),  
                    ordered = TRUE))
```

GSS Panel

```
gss_sub
```

```
## # A tibble: 14,610 × 23
```

```
##   year   id ballot  age tvhours race  sex  degree  relig  income  polviews
##   <int> <int> <int> <int>   <int> <fct> <fct> <ord>   <fct> <chr>   <fct>
## 1  2006     9     3    23      NA Black Female Bachel... None  $25000... Conserv...
## 2  2008   3001     3    25      NA Other Female Bachel... None  $25000... Extreme...
## 3  2010   6001     3    27      NA Black Female Bachel... None  $25000... Extreme...
## 4  2010   6002     1    36       3 White Female Gradua... None  $25000... Liberal
## 5  2006    10     1    32       3 Other Female Gradua... None   <NA>    Slightl...
## 6  2008   3002     1    34       3 Other Female Gradua... None  $25000... Moderate
## 7  2008   3003     3    83      NA Black Female Lt Hig... Prote... $20000... Liberal
## 8  2010   6003     3    85      NA Black Female Lt Hig... Prote... <NA>    Moderate
## 9  2006    11     3    81      NA Black Female Lt Hig... Prote... <NA>    Moderate
## 10 2010   6004     1    51      10 Other Male   High S... Catho... Lt $10... Liberal
## # ... with 14,600 more rows, and 12 more variables: fefam <fct>, vpsu <dbl>,
## # vstrat <dbl>, oversamp <dbl>, formwt <dbl>, wtssall <dbl>, sampcode <dbl>,
## # sample <dbl>, agequint <fct>, year_f <fct>, young <chr>, fefam_d <fct>
```


GSS Panel

```
gss_sub %>%  
  select(sex, degree) %>%  
  group_by(sex, degree) %>%  
  tally() %>%  
  pivot_wider(names_from = sex, values_from = n)
```

```
## # A tibble: 6 × 3  
##   degree      Male Female  
##   <ord>    <int>  <int>  
## 1 Lt High School    814   1036  
## 2 High School    3131   4143  
## 3 Junior College   440    721  
## 4 Bachelor    1293   1474  
## 5 Graduate     696    860  
## 6 <NA>         NA      2
```

More on **factors**

We've already seen **fct_relabel()** and **fct_recode()** from forcats.

There are numerous other convenience functions for factors.

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There are numerous other convenience functions for factors.

```
gss_sub %>%  
  count(degree)
```

```
## # A tibble: 6 × 2  
##   degree      n  
##   <ord>    <int>  
## 1 Lt High School 1850  
## 2 High School    7274  
## 3 Junior College 1161  
## 4 Bachelor      2767  
## 5 Graduate      1556  
## 6 <NA>           2
```

```
levels(gss_sub$degree)
```

```
## [1] "Lt High School" "High School"    "Junior College" "Bachelor"  
## [5] "Graduate"
```

More on factors

Make the **NA** values an explicit level

```
gss_sub %>%  
  mutate(degree_na = fct_explicit_na(degree)) %>%  
  count(degree_na)
```

```
## # A tibble: 6 × 2  
##   degree_na      n  
##   <ord>      <int>  
## 1 Lt High School 1850  
## 2 High School   7274  
## 3 Junior College 1161  
## 4 Bachelor      2767  
## 5 Graduate      1556  
## 6 (Missing)      2
```

More on factors

Relevel by frequency

```
gss_sub %>%  
  mutate(degree_freq = fct_infreq(degree)) %>%  
  count(degree_freq)
```

```
## # A tibble: 6 × 2  
##   degree_freq      n  
##   <ord>      <int>  
## 1 High School    7274  
## 2 Bachelor      2767  
## 3 Lt High School 1850  
## 4 Graduate      1556  
## 5 Junior College 1161  
## 6 <NA>           2
```

More on **factors**

Relevel manually

```
is.ordered(gss_sub$sex)
```

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

```
levels(gss_sub$sex)
```

```
## [1] "Male" "Female"
```

```
summary(lm(age ~ sex, data = gss_sub))
```

```
##  
## Call:  
## lm(formula = age ~ sex, data = gss_sub)  
##  
## Residuals:  
##      Min       1Q   Median       3Q      Max   
## -31.431 -13.972  -0.431  12.569  40.028   
##  
## Coefficients:  
##              Estimate Std. Error t value Pr(>|t|)      
## (Intercept)  48.9720     0.2149  227.846  <2e-16 ***  
## sexFemale    0.4594     0.2864   1.604    0.109      
## ---  
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1  
##  
## Residual standard error: 17.08 on 14463 degrees of freedom  
## (145 observations deleted due to missingness)  
## Multiple R-squared:  0.0001779,    Adjusted R-squared:  0.0001088   
## F-statistic: 2.573 on 1 and 14463 DF,  p-value: 0.1087
```

More on **factors**

Relevel manually

```
gss_sub <- gss_sub %>%  
  mutate(sex = fct_relevel(sex, "Female"))  
  
levels(gss_sub$sex)
```

```
## [1] "Female" "Male"
```


More on **factors**

Relevel manually

```
gss_sub <- gss_sub %>%  
  mutate(sex = fct_relevel(sex, "Female"))  
  
levels(gss_sub$sex)
```

```
## [1] "Female" "Male"
```

```
summary(lm(age ~ sex, data = gss_sub))
```

```
##  
## Call:  
## lm(formula = age ~ sex, data = gss_sub)  
##  
## Residuals:  
##      Min       1Q   Median       3Q      Max   
## -31.431 -13.972  -0.431  12.569  40.028   
##  
## Coefficients:  
##              Estimate Std. Error t value Pr(>|t|)      
## (Intercept)   49.4313     0.1892  261.233  <2e-16 ***  
## sexMale       -0.4594     0.2864   -1.604    0.109      
## ---  
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

More on factors

Relevel manually

```
gss_sub <- gss_sub %>%  
  mutate(degree_by_race = fct_cross(race, degree))  
  
gss_sub %>%  
  count(degree_by_race)
```

```
## # A tibble: 16 × 2  
##   degree_by_race      n  
##   <fct>          <int>  
## 1 White:Lt High School 1188  
## 2 Black:Lt High School  379  
## 3 Other:Lt High School  283  
## 4 White:High School    5548  
## 5 Black:High School    1180  
## 6 Other:High School     546  
## 7 White:Junior College  885  
## 8 Black:Junior College  206  
## 9 Other:Junior College   70  
## 10 White:Bachelor      2334  
## 11 Black:Bachelor       233  
## 12 Other:Bachelor       200  
## 13 White:Graduate      1293  
## 14 Black:Graduate       116  
## 15 Other:Graduate       147  
## 16 <NA>                 2
```

More on factors

Relevel manually by lumping ... the least frequent n

```
gss_sub %>%  
  mutate(degree_n = fct_lump_n(degree, n = 3)) %>%  
  count(degree_n)
```

```
## # A tibble: 5 × 2  
##   degree_n      n  
##   <ord>      <int>  
## 1 Lt High School 1850  
## 2 High School   7274  
## 3 Bachelor      2767  
## 4 Other         2717  
## 5 <NA>          2
```

More on factors

Relevel manually by lumping ...to other, manually

```
gss_sub %>%  
  mutate(degree_o = fct_other(degree,  
                              keep = c("Lt High School",  
                                       "High School"))) %>%  
  count(degree_o)
```

```
## # A tibble: 4 × 2  
##   degree_o      n  
##   <ord>      <int>  
## 1 Lt High School 1850  
## 2 High School   7274  
## 3 Other        5484  
## 4 <NA>          2
```

